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LABOUR AND INDUSTRY.

IN October last we cordially welcomed the establishment of a new Government Department under the presiding influence of Mr. Arthur Henderson. then the Labour Adviser to the Government, with, among its prime objects, the laying of the foundations for a regular and definite system of co-operation and communication between industry and the Government. We regarded it as the organisation needed in order that negotiations might be conducted, and material collected, which would indicate upon what new basis we might expect to be able to build our scheme for industrial harmony after the war. It was Mr. Henderson's desire to represent industry as a whole, not unduly biased in favour of Labour, nor neglectful of the interests of Capital, and suggestions were invited from both sides. The Employers' Parliamentary Council raised objection to the appointment being filled by a Labour man, but we believe that it would have been extremely difficult to suggest a course more appropriate to the situation then prevailing. In the three or four months that have since elapsed there have been important changes in our public life, and one of these has been the falling of the reins of this new Department from the hands of Mr. Henderson to those of Mr. John Hodge, also a Labour man. Now, unless we are strangely mistaken, Mr. Hodge means to hold the reins with a very tight hand—the whip as well, judging from his allusions to the failings of the soulless managers of Labour Exchanges. The present Minister of Labour was first revealed to us as a coming force in connection with our national industrial problems last year, when he presided over the great Labour meeting at Queen's Hall addressed by Mr. W. M. Hughes, the Australian Prime Minister. In our present very serious deliberations he is for the nation a tower of strength, because we believe him to have had ample opportunities for grasping the problems of the manufacturer as well as understanding the necessities and legitimate claims of the worker. We believe him to have the confidence of large numbers of the workers, and what, perhaps, is more to the point so far as this journal is concerned, of the workers connected with the iron and steel and engineering trades of the United Kingdom. Therefore, we desire to extend to him, as we did in like circumstances to Mr. Henderson, and as we did also to Mr. G. H. Roberts, M.P., now Under Secretary for the Board of Trade, on the occasion of a frank, but conciliatory and most useful, speech which he delivered at the Mansion House two or three months ago, a cordial welcome to a position of some considerable influence in national affairs. But other important things besides these changes in *per-*

sonnel have also taken place during the last few months. We have at various stages of hostilities discovered that it is an engineer's war, that it is a war of munitions, that it is a war in which the silver bullets must tell. Latterly, however, we have been learning that it is a war between the workers, and as we write, in the midst of the War Loan activity, we recognise more than ever that Capital, whether of the princely rich or of the small householder struggling with heavy bills in order to be able to buy a war-savings certificate, is the great essential if all the other forces—naval, military, munition, and agricultural—are to be provided with the equipment which will enable them to carry the Allied cause to the only Victory that will make life bearable. Equipment, then, and money for equipment now and in the coming months, are the needs of the moment, and it is important that the world should know that our millions of workers are solid in their determination to do their bit to defeat the would-be oppressors of Europe. Mr. Appleton, Secretary of the General Federation of Trade Unions, has rendered useful service in according an interview to an American newspaper, in which he has made it clear that, so far as he is able to represent the sentiments of British workers, it is unlikely that they will tolerate relations with the German working-class movement after the war, unless the German workers "immediately and forcibly repudiate the dastardly acts of the German Government." He appeals to the workers of America not to allow anything to stand in the way of efforts to bind up the wounds of Belgium and restore her to her place among the nations. He affirms that the sense of justice and of right of the roughest of British workmen is sound and true in this connection. Is it too much to hope that the truth will find its way into the German workers' minds, and that the scales will at last fall from their eyes, showing that the pressure that will be increasingly used by the Allies is in their own ultimate interest?

But to return to the Minister of Labour—we welcome the note of optimism with which he has commenced his very difficult work. We must remember that he has been all his life connected with our steel industries, and that, therefore, inevitably those industries loom very largely on his horizon. In Press interviews, he has just expressed the firm conviction that there is certain to be a boom after the war; also that in many factories now employed in war-work there need be no stoppage at all, only a change-over from one class of manufacture to another.

> Factories that are making steel for war purposes must be immediately directed to supplying steel for industrial purposes. Industries are now being starved for steel, and they will want all they can get. Shipbuilding will be pushed on as rapidly as possible. Therefore there will be full employment for engineers generally. Engines and cranes and machinery of all kinds are now being worn out. The present is not the time to renew them—that lies with the future. Many things that we are now making the best of in all departments of life will call for instant renewal, and it will all mean more work.
>
> I do not really think that there will have to be very much displacement of labour. I believe there will be a keen demand for open-air work when the men come back. The land will attract many thousands. In fact, for some trades, such as the leather and building trades, the difficulty will be to find the men to do the work.

Our duty, however, is to be prepared by means of existing, and, if need be, additional, organisations for facilitating the return of demobilised men to their former avocations if they desire, or to such other occupations as their state of health and altered dispositions incline them. If we make suitable plans in good time, we may be able to carry through the change with a minimum of friction, and we can the better make plans which will be acceptable to all parties if there be that spirit of co-operation between employer and employed under Government auspices, for which we are all longing.

It has been put to Mr. Hodge by some employers that in the past the Government has consulted Labour more than Capital. That is an old grievance of industry which we should not have cared to dwell upon too pointedly just now for fear of spoiling the atmosphere, but Mr. Hodge is not going to shut his eyes to indisputable facts. Whether or not he accepts the employers' complaint as being accurate, he makes it clear that, as Labour Minister, he will not pursue that policy. "Both sides must be heard; otherwise it will be impossible for confidence to be retained." We are sure that this attitude will be hailed by right-minded men on both sides as the only fair and equitable one. A number of preliminary conferences between masters and men have been held, and it appears that these are to form but the prelude to bigger conferences or co-ordinated policy which may make actual working agreement practical in due course. Indeed, it is announced that to-morrow there is to be held at Birmingham a meeting of the newly-formed National Alliance of Employers and Employed. Mr. Neville Chamberlain, who, as we have already shown, has been deeply interested in the relations of Capital and Labour after the war, is to preside, and Mr. Hodge and Mr. Appleton will probably be present.

Taking for granted a boom in trade, with plenty for the engineering and iron and steel, and some other, trades to do, and assuming a spirit of harmony between Capital and Labour, what we have to see to is that the way is clear for fighters to return to work and present workers, as far as necessary, to change over to whatever their future occupations are to be. The ease with which these operations can be conducted is dependent in part upon the number of men to be demobilised from the Army, the absorbing power of industry, and the rate at which both the Army and the munition workers are to be demobilised. We gather that the Demobilisation Committee, in an interim report, estimates that the Army will release 30,000 men per week, and we can roughly calculate over what period demobilisation would be spread if we assume the number of millions ultimately to be freed. The rate of demobilising munition workers is to be recommended in a report that is promised by the Reconstruction Committee. It depends, we suppose, upon too many factors for any estimate other than of a most speculative and unreliable nature to be made, but we must, in the absence of other information, presume that Mr. Hodge has some good reason, officially based, for his belief that there will not have to be very much displacement of labour. Nevertheless, when the soldiers do return, and when such munitions workers as are not required are to be released, we shall require a most efficient organisation in a state of complete readiness to begin operations to get the industrial, commercial, and, may we add, the professional, forces back to peaceful callings. It is one of Mr. Hodge's duties, as Minister of Labour, to see that this organisation is established on right lines, and in time. He naturally turns to the system of Labour Exchanges, which was set up some years ago, and has worked in some places satisfactorily, and in others not so. He proposes that these Exchanges form the nucleus of the said organisation, but he knows that the past has not left a halo of glory around the heads of these departments. They appear to be disliked both by employers and by Trade Unionists. Our own "Correspondence" columns, and those of other technical journals, have shown that for certain classes of engineers the Labour Exchanges have been far from satisfactory, and the mere necessity of having to apply through them has aroused a sort of professional resentment. There need be no ground for such feeling if the Exchanges be conducted in a proper manner, that is, as Mr. Hodge says, "with sympathy and under-

standing." We hope that he will succeed in securing the appointment of committees which shall control the policy of the managers of the Exchanges and make them "live organisations." It is of the greatest possible importance, as he recognises, that the men in charge should try to understand "what a man who registers is fitted for." Mr. Hodge says that his Department is seeking to anticipate the report of the Demobilisation Committee by planning the extension of the Employment Exchanges, "so that, in the event of Peace coming on us hurriedly, we may be in a position to handle the great problem of demobilisation promptly and efficiently." In that work of extension, the atmosphere of suspicion must be cleared away, and a spirit of sympathy must take its place, so that all the parties who ought to be able to relieve the situation may co-operate with the best possible results. We are glad to observe that, optimist though he is, and eager to weigh up the merits of all parties, Mr. Hodge does not underestimate the difficulties of the situation, and the engineering industry will wish for him, and for the other authorities who are at present engaged preparing the way, a complete success to their efforts, for the matter concerns the early future of the whole nation. We trust that to-morrow night's meeting at Birmingham will signalise a real advance in the movement toward harmony.

Our Trade with New Zealand.

WE commend to the earnest attention of our manufacturers the interesting report by Mr. R. W. Dalton, H.M. Trade Commissioner in New Zealand, on the position of the import trade of that Dominion. He finds, as might be anticipated, that the sentiment is strongly in favour of manufactures from the Mother Country, not only because of kinship, but because it is recognised that trade between the Dominion and Home must be encouraged in the interests of the Empire. Doubtless owing to the heavy war demands upon our engineering factories, the exports to New Zealand fell off to some extent in 1916, but if our firms are able to take appropriate action to increase the efficiency of their selling organisations without delay, there should be little difficulty in regaining any lost ground at the close of the war. But we gather from Mr. Dalton's remarks that what we have already stated in regard to other markets is equally true of New Zealand, namely, we need to acquaint the buyer there at once with the reasons for our inability to do all that we should like to do to meet their requirements, and to assure them of the undoubtedly better position in which we shall be as electrical and engineering manufacturers as the result of our present war industrial activities. We may, however, leave the report to speak for itself on this and other interesting points, such as the danger of losing to foreign firms good agents who ought to be secured before their hands are tied.

We must remember that electrical matters are beginning to move very satisfactorily in New Zealand. The Lake Coleridge power scheme is likely to prove a success. All the power that can be produced is taken up on contract, and there is still an unsatisfied demand which can only be met by extension. The progress of this scheme has also given rise to a disposition to develop other water powers, of which there are many throughout the Dominion. A recent declaration of one of the Ministers indicated that careful inquiries were being made with a view to the provision of electrical power throughout the North Island by the construction of one or two stations. It was hinted some time ago that the Government were going to take over the Hora Hora power works, which supply power to the Waihi Gold Mines. This was subsequently denied, but there can be no doubt that electricity, and all the appliances that it brings in its train, are destined to have a big future in New Zealand. America is having a great time at present, partly because of efficient and energetic representation when others are perforce inactive, and it will require an effort on our part to recover ground which has necessarily gone to them during the war.

We are informed that the deficiencies of British trade are inexperience with high-tension plant and with water-power and turbines. It is also stated that there is a backwardness in the production of up-to-date cooking and heating appliances as compared with the American. Labour is, of course, a great problem, and any labour-saving device is at a premium. The country is one of great promise from every point of view. It can prosperously accommodate a vastly increased population, and electrically the outlook is the brightest for British firms if they can only be prepared to handle the situation enterprisingly, either now or immediately war demands begin to ease off.

Dublin Again.

As recorded in our last issue, Mr. L. J. Kettle, Deputy City Electrical Engineer to the Corporation of Dublin, is not minded to let judgment go by default; he considers that Col. d'Alton's reports reflect very seriously upon his own technical abilities, and adopts the characteristically Irish expedient of issuing a sporting challenge to the Colonel to make good his criticisms on the floor of the electricity works; he is prepared to run the works—or the undertaking—for a week or a month or a year against Col. d'Alton, and guarantees to show at least equally good results, the stakes being the salaries of the combatants—plus, we suppose, their professional reputations.

We admire the spirit of the challenge, though we do not see the remotest possibility of its being accepted. We are bound to sympathise with Mr. Kettle, whatever the merits of the quarrel, for it cannot be denied that the Corporation never gave either him or Mr. Ruddle a fair chance to do the best for the undertaking. We have neither time nor inclination to discuss the pros and cons of the controversy, which has already evoked an amazing superfluity of reports and, we have no doubt, a corresponding chaos of undercurrents such as usually confuse the issues of any Irish argument; some inkling of the situation may perhaps be gathered from the last paragraph of Mr. Kettle's letter, in which King Charles's head pops up in the shape of a reference to the need for "a good system of Home Government" as the only thing that will improve the load factor—but that is by the way. What we wish to say is this: in these strenuous times it behoves us, one and all, to sink all personal considerations and work solely, whole-heartedly, and with our utmost energy for the good of the State, and of every community in the State. It occurs to us that if Mr. Kettle could forgo his quest for blood and join hands with Col. d'Alton in the one great aim of placing the Dublin electricity undertaking on the soundest possible financial, commercial, and technical basis, he would perform a feat worthy of the highest commendation. Granted that it would necessitate an heroic effort of self-abnegation—but great deeds are not achieved by little men, and we sincerely believe that by adopting this course Mr. Kettle would not only earn the gratitude and esteem of his fellow-citizens, but would also most surely attain the goal of his ambition. There is nothing derogatory to the dignity of a central-station engineer in collaborating with a consulting engineer—it is an every-day occurrence—and it is to be hoped that, in the interests of Dublin City, both Col. d'Alton and Mr. Kettle will give the matter careful consideration from this point of view.

CABLE JUNCTION BOXES.

BY S. G.

(*Concluded from page* 32.)

Disconnecting Links.—These take various forms, according to the likes and dislikes of the designers and users.

Fig. 12 illustrates an ordinary "bolted down" flat link; a brass set-screw or a stud and nut can be used for fixing. For alternating current, lock nuts or spring washers should be used.

An improvement when a stud and nut are used is shown at fig. 13. As will be seen, the stud has a projection turned

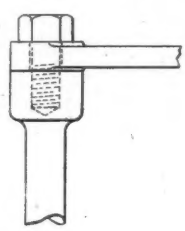


FIG. 12.

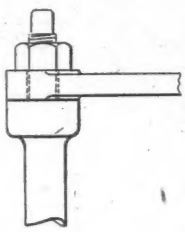


FIG. 13.

on the end; this prevents the nut from falling into the box when it is being undone with the spanner.

The bolted faces of all disconnecting links and fittings should be perfectly smooth; the current density on these faces should not exceed 200 amperes per sq. in., and the sectional area of the fittings should be such that the current density does not exceed 800 amperes per sq. in. in copper.

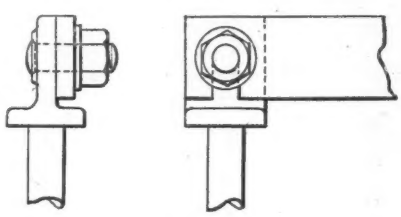


FIG. 14.

Another form of disconnecting link is shown in fig. 14. This design allows the link to be disconnected without the entire removal of the nut and washer, the link being slotted.

Fig. 15 illustrates a spring contact link. The advantage of this type of link is that it can be readily removed without the use of a spanner. The current density in the spring contact as well as the link should not exceed 800 amperes per sq. in. in copper, and the contact surface should not carry more than 200 amperes per sq. in. As will be seen, the contact clips are sweated into the contact block, and, if desired, they can be riveted in addition.

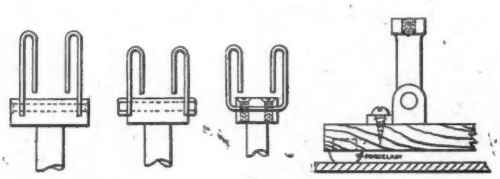


FIG. 15. FIG. 16. FIG. 17. FIG. 18.

Fig. 16 illustrates similar contacts bolted to the sides of the contact block, and more easily renewable.

Fig. 17 illustrates a similar contact, the whole of the clip being made in one piece.

In order to turn out a good job with any of the above spring contacts, it is absolutely essential that the links be "ground in" properly, first using a fine powder with oil, then thoroughly cleaning both links and clips, and finally "grinding in." It is not good enough to take the clips direct from the press and the links direct from the milling machine and mount them in the box. If the job is worth doing at all, it is worth doing well and properly.

The mounting of fittings inside the box is a point which requires special attention.

In the old days, fittings were mounted on any kind of wooden base; then teak was adopted as a standard method for many years, and is, in fact, used to a great extent even now.

For the better class of insulation, porcelain has superseded teak, and now there is a tendency for porcelain to be superseded by iron or steel bars covered with micanite.

Of course, for E.H.T. work nothing, in the writer's opinion, can be compared with porcelain boxes, and for all H.T. and E.H.T. work shields or separators should be used between the poles or phases.

Fig. 18 illustrates a fitting mounted on a teak base for voltages not exceeding 500. The base should be well boiled

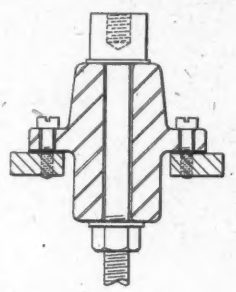


FIG. 19.

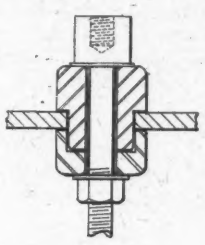


FIG. 20.

in paraffin wax, and a strip of mica should be placed between the fitting and the base. The base should rest on porcelain buttons.

Fig. 19 illustrates a fitting mounted on porcelain insulation for either L.T. or H.T. work, the length of the insulator varying according to the voltage.

Fig. 20 illustrates another form of porcelain insulation, the difference being that two insulators are used; the hole

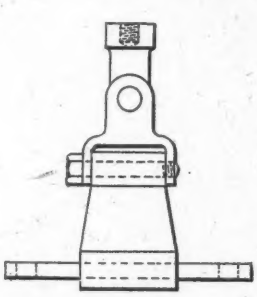


FIG. 21.

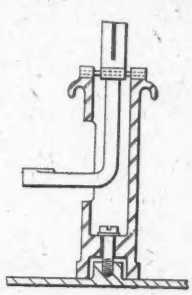


FIG. 22.

is bushed with a mica tube, and the pair are gripped on to an iron bar by means of the contact stalk.

Fig. 21 illustrates another form of porcelain insulation. The insulator is threaded on to a wrought-iron bar, and the fitting is bolted on to the insulator.

Fig. 22 illustrates what is known as the "mushroom" insulator.

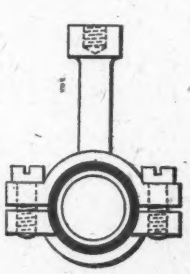


FIG. 23.

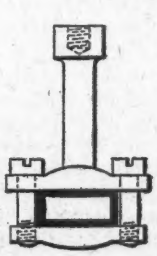


FIG. 24.

Figs. 23 and 24 illustrate how the fittings are mounted on metal bars covered with micanite; in one case a light steel tube is used, and in the other case a flat wrought-iron bar is used.

This method of insulating was first adopted, so far as the writer recollects, on controller work, about 11 years ago, with good results.

Fig. 25 illustrates a disconnecting link mounted inside a

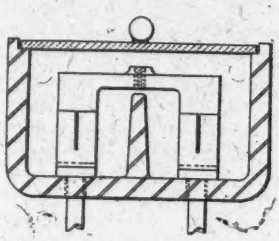


FIG. 25.

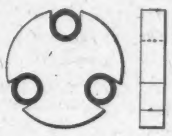


FIG. 26.

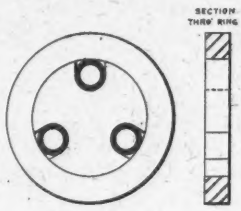


FIG. 27.

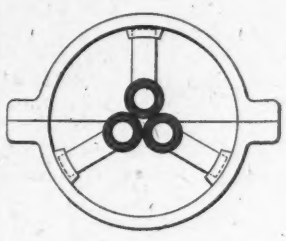


FIG. 28.

porcelain box which is provided with a glass lid. The advantage of this type of mounting is the high insulation obtainable and the small amount of risk from accidental contact with the live parts.

Spreaders and Separators.—Non-disconnecting joint boxes for "core" cables are sometimes, but not always, provided with

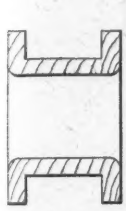


FIG. 29.

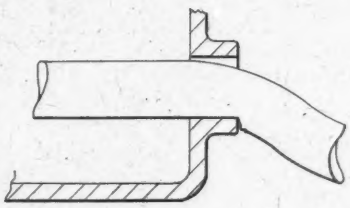


FIG. 30.

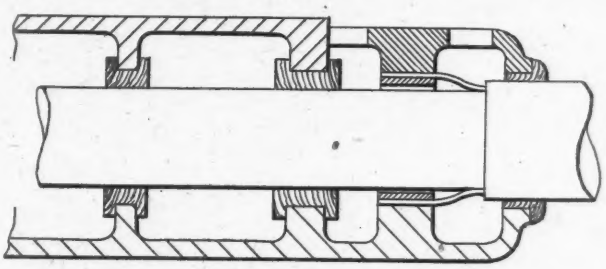


FIG. 31.

these, and it is generally a matter of opinion whether they shall be employed or not. In the writer's opinion the best job, although a little more expensive, is where spreaders are used. Spreaders take various forms, as will be seen by referring to figs. 26, 27, and 28, the materials used being either teak, ebonite, or porcelain.

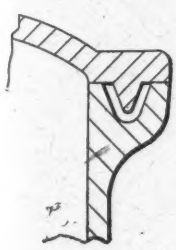


FIG. 32.

FIG. 33.

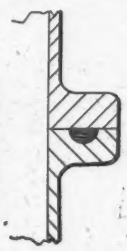


FIG. 34.

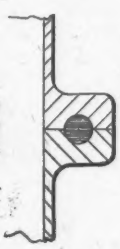


FIG. 35.

Wood Bushes.—Cables should on no account be taken through the holes in the boxes unless the latter are fitted with wood bushes, well boiled in paraffin wax, with the sharp edges of the holes taken off, as shown in fig. 29. These wood bushes prevent the cable from being damaged by the small pieces or sharp edges on the cast-iron, which, in the case of a rubber or bitumen cable, have been known to cut right through the insulation, as in fig. 30. The length of the wood bush should be considered in relation to the diameter of the cable, and the following dimensions are suggested: for lead-sheathed cables, length of wood bush = D × 1. For rubber or bitumen cables, D × 1·5, where D = the diameter over the insulation.

Compound Pockets.—Fig. 31 illustrates a compound pocket added to the end of a junction or network box gland. This pocket is used for sealing-off the end of the cable, and, as will be observed, improves the appearance of the joint when completed.

Lifting Handles.—All lids of disconnecting boxes should be provided with lifting handles made of wrought-iron, and cast into the lids of the boxes. Cast-iron handles are useless, as they get broken off either en route or on site.

Fixing Feet.—Sometimes boxes are required for fixing on a wall or on the floor, in which case it very often occurrs that the designer or draughtsman overlooks the fact that strength is the ruling condition. This point should receive special attention, for a broken fixing foot is almost equivalent to the whole box being broken. It is not only in the erection that breakages occur, but on the railway as well. Wrought-iron fixing straps are often used, but in most cases they look ugly.

Coating of Boxes.—All cast-iron underground boxes should be coated with compound. The compound usually used is known as "Dr. Angus Smith's Compound."

A formula for this is as follows :—

Coal tar, 1 cwt.
Slaked lime, 10 lb.
Pine resin, 4 lb.
Tallow, 7 lb.
Coal naphtha, sufficient to thin down.

If the castings, when taken fairly hot from the sand, are plunged into a vat containing this compound, left for a short time, and then allowed to drip, it will be found that when cold a very good coating is produced, which is a good protection against rusting.

Pavement Frames and Covers.—Thousands of these are at present in use, and I think there is only one point which requires the designer's special attention—and that is, when the pavement frame forms part of the cast-iron pit, it should be remembered that sometimes they are placed on pavements which have a more or less steep gradient, in which case the cast-iron pit must be provided with suitable adjusting screws to adjust the frame and cover to suit the angle of the pavement.

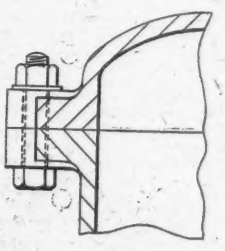


FIG. 36.

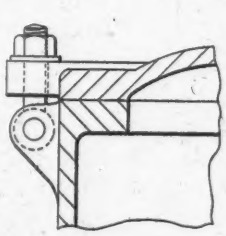


FIG. 37.

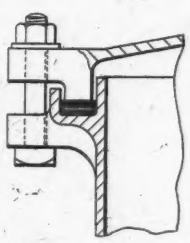


FIG. 38.

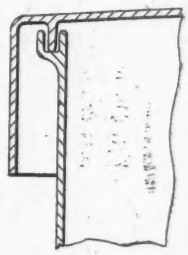


FIG. 39.

Lead Sleeve Joints.—Lead sleeves are very often employed in making joints on three-core cables, mostly for H.T. work. The sleeve is plumbed on to the lead sheathing of the cable, and in most cases the complete joint is enclosed in a cast-iron shell or box, both the lead sleeve and the cast-iron shell being filled with compound.

A cheap form of underground house service box is also made by means of lead sheet pressed into the required shape, and, when fixed in position, it can be "bricked up" for protection.

Lid Joints.—These take various forms according to special requirements, and to the likes or dislikes of both designers and users.

Fig. 32 illustrates a common tongue-and-groove joint which is commonly used in almost all non-disconnecting boxes; the groove can be filled with compound or packing material, such as cotton, spun yarn, &c.

Fig. 33 illustrates a miniature tongue-and-groove joint, sometimes, but not often, used.

Figs. 34 and 35 illustrate what is known as a "split" joint, the groove being filled with compound or packing.

Fig. 36 illustrates a bolted "machined" joint. This type is rather expensive, but has its advantages.

Fig. 37 illustrates a similar joint, but the parts are secured by means of a swing bolt (a wing nut can be used, if desired).

Fig. 38 illustrates what is known as a "bolted-down packed joint."

Fig. 39 illustrates a "diving-bell" lid, and is used for disconnecting boxes, where the lid can be removed quickly without having to waste time undoing a number of bolts and nuts.

Compound.—It was not until paper-insulated cables were manufactured that much, if any, attention was given to the filling of joint boxes with compound.

In about the year 1900 trouble in this respect began to show itself, and it was then that cable engineers began to look around to find means of overcoming the trouble.

It often occurred that one was called out at midnight, or in the early hours of the morning, to locate a fault, which

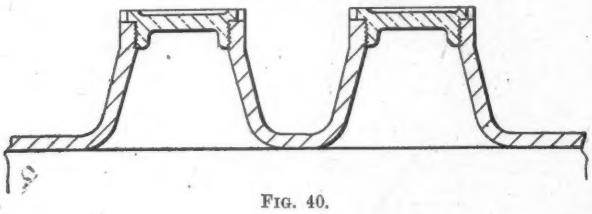


Fig. 40.

was often traced to moisture having crept along the cable due to the end of the same not being properly sealed.

In those days faults were not so easily located as they are at present, and it very often occurred that quite a long length of excavation had to be made before the fault could be found.

Not only was there the inconvenience of getting out of a warm bed at midnight, especially if it happened in winter time and the ground was covered with snow, or perhaps it was raining very hard, but also the expense of pulling up the road and reinstating it.

In the first place, a suitable compound should be used. By suitable, I mean one which is suitable for the voltage at which the cable is working, one which will adhere properly to the cast-iron box, and one which is suitable for the climate.

The actual filling of the box with compound is a matter which requires very careful attention. It often occurs that insufficient time is allowed for this procedure; this is a grave mistake, and is bound to be discovered sooner or later.

Care should be taken when melting the compound on a fire or "devil" in a bucket to melt it slowly, and as soon as it begins to soften around the edge of the bucket, it must be constantly stirred and kept on the move by means of a ladle or other suitable metal article which is clean and near to hand. A wooden stick must not be used until all the lumps are thoroughly melted. Do not let it boil.

Whilst the compound is melting, the box must be thoroughly warmed all over with a blow lamp. This part of the business is often neglected, sometimes due to impatience on the part of the jointer, sometimes for other reasons.

I would here emphasise the fact that it is absolutely essential that the whole of the box be thoroughly warmed before being filled.

When the box and the compound are quite ready, filling can be commenced.

The jointer must keep the blow lamp playing all over the box during the whole of the time of the filling, so that the temperature of the box is not reduced. The compound must be poured in a little at a time until the box is filled.

The box can then be left to cool; when cool, and contraction has taken place, it can be topped up.

The lids of all boxes which have to be filled with compound should be domed, and the filling holes should be placed at the highest point of the dome.

An improvement on this is shown at fig. 40, two spouts being cast on the lid.

In order to overcome the formation of cavities or blowholes in the compound experienced with the ordinary methods employed in filling boxes, special filling funnels have been designed. One is known as the "Dickenson Cover," and another the "Glover Filling Funnel."

Finally, I would emphasise the fact that if the ordinary method of filling is adopted, it must on no account be rushed. It is a business which requires patience, and sufficient time must be taken to do the job properly.

SOME CONSIDERATIONS AFFECTING THE USE OF ELECTRICITY IN AGRICULTURE.

One of the most unsatisfactory features of the past two years has been the persistent indications that British farming, almost alone of all our industries, has failed to respond in anything like the required degree to the urgent call for increased effort to meet the emergency conditions arising out of the war.

This is not a matter for surprise, as the outbreak of war found our agricultural industry not only sadly neglected, in the sense that it does not appear to have been anybody's duty to provide it with the scientific and commercial organisation which is essential to a prosperous industry, but also greatly embarrassed by a long period of ruinous competition to which it was condemned for political rather than economic considerations. The seriousness of the resulting situation to a nation at war can scarcely be over-estimated, for food is an essential factor, possibly determining the issue of the conflict, which the gigantic scale of modern operations appears to render more and more difficult of decision on the battlefield. Thus it is fair to rank food as a munition of the first importance, and to secure at all costs the industry involved in its production, though—astonishing as it may seem—this view of the matter is only dimly appreciated by the average individual, and even official circles have only recently translated their appreciation into decisive action.

A recent article in the *Daily Express* appealing to the then Minister of Agriculture, and urging him "to assert himself and make his Ministry a reality," said:—"The problem of agriculture is the problem of the greater part of the nation's food. It should be dealt with as a whole, and every part should be co-ordinated to the other parts. All the indications to-day are in the direction of piecemeal compromises, which will lead us nowhere except into a position full of the gravest peril."

We refer to this subject now, as on previous occasions, because we believe that the successful future of our agricultural industry is intimately bound up with the organised application of electricity to agricultural uses on a large scale, and that if the problem is to be dealt with as a whole, as it obviously should be, then careful consideration must be given to the prospective use of electricity on farms in all

those areas where a supply of electricity can be made available with our existing resources.

After all, farming, in common with every other industry employing labour, is more or less an engineering problem, to the extent that labour-saving machinery may be adopted in connection with it, and because farm power, owing to the very nature of its employment, is more than ordinarily liable to inefficient production and wasteful application under average conditions of use.

To put the matter quite frankly, the farming industry, in comparison with other leading industries, has, as regards the methods employed, been nearly stationary for more years than most of us can remember; and it is not easy to account for this, except on the hypothesis that those interested in it have never treated it seriously, and have, therefore, lacked the necessary enterprise to adapt the practical teachings of the engineer and chemist and commercial organiser to their own line of business.

It is well to note, however, that farming is "not as other industries," and factors enter into its successful conduct which differentiate it from most other industries which have adopted electrical methods, and frequently found it profitable at the same time to modify their processes and ideas.

These matters have been discussed by various writers, and Dr. Russell* points out a fundamental distinction—namely, that, except in rare cases, the farmer does not grow for contracts, but always for "stock"; the manufacturer knows exactly what he will be paid, as a rule, and, therefore, what he can afford to spend and how far he can go in introducing new methods. The farmer cannot do this; he cannot be certain either of his crops or what price he will get for them, and he lays out money on a crop which will not be sold for 15 months.

While we think that Dr. Russell has underestimated the speculative risk attaching to ordinary manufacturing operations, it is a fact that the weather introduces an unusual risk in the case of farming, interfering with labour at times, and at others seriously influencing growth and ingathering.

On the question of farm labour, Mr. Wibberley† argues that, judged from an efficiency standpoint, the rate of wages is actually higher on the land than off it; the men must be paid on the farm whether they are performing effective work or not, and practically all the tillage operations are crushed into about a ten-week period in the autumn, instead of having an even labour distribution throughout the year, unaffected by weather conditions. We may add that Mr. Wibberley goes on to urge the adoption of a system of "continuous cropping," which is described as an attempt to farm on factory lines, *i.e.*, to spread out tillage operations over the greater part of the year, an arrangement which would obviously tend to more efficient use of machinery and labour. An article in our American contemporary *The Central Station*, some months ago, referred to the "factory idea" in farming, pointing out that the real secret of the transformation is electricity, which is saving farm life from its monotonous drudgery. The transmission line gives the farmer an independence of action which he has not had before. Far-seeing owners of large interests, it says, realise that the farms of the United States, conducted on business lines, are assuming the character of conservative business propositions through the agency of central station power; further, the central station managers are urged to remember this fact—and this admonition should be noted with interest in this country. Looking at the problem of maximum production of food purely from the abstract point of view, it is evident that the farming industry, in common with others, can with advantage modify existing methods, particularly if the full benefit of engineering developments is to be secured.

Farming on a scale consonant with engineering ideas of efficiency and labour economy is clearly not easy of accomplishment in a country where farms and fields are, for the most part, comparatively small in extent, and where, moreover, the situation is complicated by the numerous tenant farmers.

However, it will be admitted that from an engineering, and especially an electrical, point of view, 20 100-acre farms can be dealt with with greater success as a single unit than if treated separately, and if, as would seem a logical possibility of the future, larger commercial and financial interests are involved in home production of food, it can scarcely be doubted that the engineering side of farming, and any reorganisation of method necessitated in its development, will be regarded as essential to success.

That the ideas outlined above are by no means utopian, is shown by a recent American venture described in the *Scientific American*, under the title "How Wall Street Tills the Soil."*

In this case a large New York City farming company has reclaimed and cultivated a marsh, now known as Oak Orchard Farm, covering apparently about 20 sq. miles, which is employed in general farming on modern industrial lines.

To quote the article, "Corporation ideals, corporation methods of handling employés, machinery, costs manufactures and sales, and corporation efficiencies—all these are being applied to the tilling of the soil. . . . Capital is growing things in the ground—after the fashion of her own successful experience in other lines." The conversion of the swamp was an engineering achievement, a wide drainage canal being dredged down the valley with 100 miles of lateral ditches; the company drained, cleared, ploughed, harrowed, sowed, and harvested certain areas within 12 months.

Practically nothing but oil tractors, ploughs, and cultivators are employed; miles of telephone wires connect the various quarters, while the villages, silos, canneries, and packing plants employ both electric light and power. It will be conceded that farming in this case is rapidly becoming a manufacturing business; an unusual amount of machinery is employed, and this appeals to the interest of the employés who learn something else but hand labour. If the farm can be made to offer an adequate return on capital, when conducted on industrial lines, what sound reasons are there for neglecting intensive farming?

The Editor of *Farm, Stock and Home*, in voicing advanced American opinion, says "we are faced with the necessity of choosing between co-operative effort on the one hand and corporate farming on the other, at least along many lines. The economic tendencies are, of course, all in the direction of *larger units of operation*."

It is safe to assume that the fuller realisation of our own recently-awakened national aspirations in the matter of food production will sooner or later result in similar developments in this country, and it is up to us to ensure that such development shall be "all-electric" wherever possible. This ideal, however, will not be achieved unless our electrical supply authorities adopt a more enlightened attitude than they have done in the past in regard to agricultural electricity supply; the knowledge that, for instance, an organisation existed with the sole object of promoting the commercial use of electricity on the farm, would encourage engineers, agriculturalists, manufacturers of plant, and others interested in this many-sided question, to arrive at an understanding, and to scheme for some definite and tangible result.

American views on this subject are, of course, well known, but we may quote the view of the *Journal of Electricity, Power and Gas*, that the future of agricultural power, particularly in the Western States of America, where electric power is available in most agricultural regions, is dependent upon the development of electric tractors and farm implements. Electric motors are practically foolproof, and require little or no attention; electric pumping has largely displaced gas-engine pumping; electric-driven saws, feed grinders, ensilage cutters, hoists, threshers, shredders, huskers and shellers are in daily use. The farmer's wife cooks, sweeps, irons, churns and performs many other household duties with electricity. The one thing needed to complete the electrical equipment of the farm, and relegate the horse to a well-earned rest, is an electric plough, low in first cost, easy to handle, of large overload capacity and rugged in construction. A great reward awaits the designer who surmounts the difficulty. Such a device, our contemporary says, would meet with a large sale, and would be a most desirable load for central stations. Electric farming will be one of the most important factors

* Pres. Address, Agricultural Section, B.A., 1916.
† T. Wibberley on "War-Time Farming."

* Article by J. R. Colter, August 19th, 1916.

in promoting the back-to-the-farm movement, upon whose success the material prosperity of the country depends.

It will be noted that this contemporary does not refer to the future development of electro-culture in farming; the careful investigation of the subject* which is being carried out in this country, however, and the promising results so far obtained, justify the inclusion of electro-culture of crops as one of the most important prospective electrical developments in farming in this country, from the agriculturalists' point of view. It is, for instance, known that beyond a certain stage the increased use of fertiliser does not yield a material increase in crop; the latter reaches a limit of growth under the conditions existing, and for the extra fertiliser to take effect, the limiting factor has to be removed. This stage is reached by the agriculturalist operating through the soil; but plant growth is dependent on both material and on radiant energy of the sun, the material being largely obtained from the air, and it is here that electro-culture may come to the aid of the older method, and possibly help to raise the limit referred to above. It may be noted here that the Royal Horticultural Society, in co-operation with the Board of Agriculture and the Imperial College of Science, is conducting an extended field trial of the effect of electricity on plant growth; investigations of a more or less scientific nature have been numerous in the past, and we believe a comparatively large scale trial of the method on commercial lines is contemplated in the West of England at the present time.

It is to be hoped that sufficiently good results may be obtained in the near future to convince even our scientific agricultural experts—who, generally speaking, have shown a marked indifference to electro-cultural developments—and even to modify the advice tendered by Mr. Middleton† recently to "speed the plough" as a means of increasing our home-grown supplies of food.

The employment of electro-culture promises a much less laborious and less costly method of increasing crop production than ploughing new land, if the results can be satisfactorily established.

To summarise the position, we have in electricity an agent which provides the following advantages in use:—

Farm Lighting.—It is hygienic, free from fire risk, and from contaminating properties, extremely flexible in application, and always immediately available.

Farm Domestic Uses.—The numerous small power and heating applications make it an ideal labour saver and the only economic means to avoid drudgery.

Farm Power.—It is the ideal power for the farm, using simple, robust, and relatively cheap apparatus specially adapted to unskilled labour; it is always available at any moment; is flexible in application, and in the case of central station supply, increased demands can be easily arranged for and met.

Transport.—The simplicity, rugged construction, and cheap operating cost of the electric vehicle will ultimately lead to its adoption for certain classes of farm transport. The electric vehicle has a low fire risk, can be driven by unskilled labour, and its battery equipment can be utilised for temporary lighting and small power applications in an emergency.

Electro-culture.—Previously referred to; may ultimately provide the farmer with a means of increasing his output beyond the limits commercially possible to-day, and at relatively low cost.

No other form of energy is capable of such a diversity of useful applications, is so economical in use and cheap in cost, or has such excellent prospect of becoming still cheaper. Moreover, no branch of science shows greater promise of increasing utility to mankind in the future. And, surely, it requires but little imagination to assume that in the greater scheme of organised agriculture in the future, electricity must, *if the position is properly appreciated*, play a prominent, and probably an indispensable part. Needless to add, this appreciation will not come about without organised effort on the part of electrical engineers in the first instance.

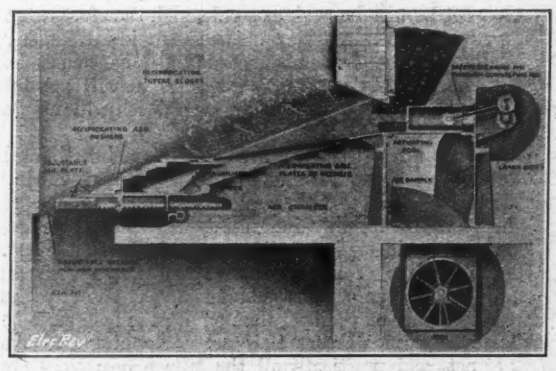
(To be continued.)

* See ELECTRICAL REVIEW, Oct. 27th and Nov. 3rd, 1916.

† Board of Agriculture Report on German Agriculture.

THE ERITH-RILEY STOKER.

THE universal adoption of turbo-generators has enormously reduced the space required for the generation of electrical power, particularly in large central stations employing large-unit generators.



DIAGRAMMATIC SECTION OF ERITH-RILEY STOKER.

The inevitable result has been the development of large-unit boilers, to give high duty in minimum space.

This, in turn, has led to rapid developments in mechanical stokers, which are naturally essential for large boilers; for instance, it would be utterly impracticable to fire by hand labour a boiler that burns five tons of coal hourly, which is below the limit already reached in practice.

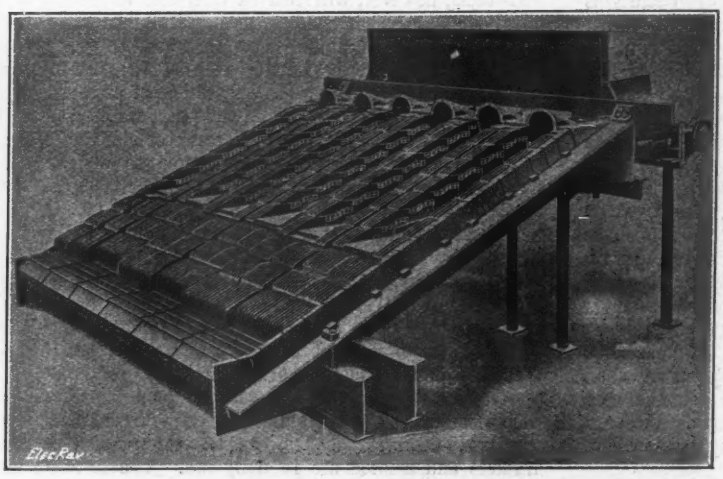
Mechanical stoking and mechanical draught is also essential for smokeless and economical combustion at varying loads, even on small and medium sizes of boilers; and the ideal system for large power plants involves continuous mechanical handling of coal to the stokers and continuous discharge of the incombustible ash.

The Erith-Riley stoker, as adopted for central stations at Manchester, Rotherham, Hull, Edinburgh, Hartlepool, Luton, Worcester, Fulham, &c., is the latest development of the Erith grateless underfeed stoker; it gives identical combustion, plus continuous cleaning; and it is this fully-automatic working at all loads which accounts for its extremely simple construction, all devices for intermittent manual operation being absent.

As our illustrations show, it is of unlimited unit capacity, being composed of any number of retort-units.

In all sizes, the furnace is entirely archless and undivided, even for boilers with furnaces 30 ft. wide. This most desirable feature is only possible with entirely underfeed combustion and continuous automatic cleaning.

Just as in the Erith stoker introduced in 1900, the coal is mechanically fed into each trough or retort by slow-moving rams; the coal spreads along the retorts, and rises upwards and rearwards over the tuyeres at the sides of the retorts. Air for combustion is positively supplied by fans into the closed ashpit or air chamber on the underside of the grateless stoker, and enters the furnace exclusively through the tuyeres, which distribute it equally over the entire zone of active combustion, whatever the



TUYERES, ASH PUSHERS, &C., ERITH-RILEY STOKER.

number of retorts used per stoker. The whole area of the retorts and tuyeres is thus devoted to active combustion; the fuel is always in three layers, viz., (1) unburnt coal in the troughs or retorts; above this (2) is the coking zone, covering a layer of ignited fuel extending over the full area, this coking zone involving only moderate temperature. Above the coking zone, but not in contact with metal, is (3) the upper layer of incandescent fire into which the fuel is constantly raised after coking; and thus combustion is smokelessly completed with a very high final temperature, and this incandescent fire radiates direct to the boiler tubes. A thick bed of fire being carried, the upper layer forms its own combustion arch, so that all occasion for coking arches is absent, and thus all partition walls and perishable firebrick arches are useless. In this way it has always been practicable to get as smokeless and efficient combustion in the water-lined furnaces of internally-fired boilers as in any brick-crowned furnace, or with any water-tube furnace setting; but by adding to these well-known features of the Erith grateless stoker the continuous discharge of ash under the Riley patents, unlimited unit capacity and completely automatic working is attained by the Erith-Riley stoker.

In all previous underfeed stokers the tuyeres were stationary and the cleaning intermittent, involving complicated mechanism as well as severe manual labour at the cleaning intervals; and, for the same reason, the length of the retorts had to be restricted to suit hand-poking for clinkers, with a corresponding limitation of tuyere capacity, and of the duty per retort.

In order to get sufficient coal-burning capacity for high-duty compact boilers, this limitation led to the development of double-ended boilers with an underfeed stoker at each end, thereby doubling the stoker cost. But, for many reasons, double-ended boilers are highly inconvenient, and they are never likely to become popular.

With the Erith-Riley stoker, however, there is no occasion for double-ended boilers, as the patented feature of reciprocating tuyeres keeps the fires continuously sliced, and the incombustible ash is continuously discharged at all duties, and thus all intermittent manual operations are avoided, simplifying the mechanism, eliminating the severe manual labour of dumping ash and poking down clinkers; and, further, making it easy to increase the unit capacity by extending the length of retorts and adding more tuyeres, and thereby extending the active combustion area.

The unitary construction not only assures archless furnaces without limitation of furnace width, but makes it very easy to assemble all sizes of stokers; thus one 18-retort stoker is merely two 9-retort stokers (or three 6-retort stokers) assembled together instead of separately.

The positive supply of air by a fan, diagrammatically shown in the section of the furnace, together with the entirely underfeed combustion and continuous cleaning, ensures the greatest flexibility, both air and coal responding to varying loads.

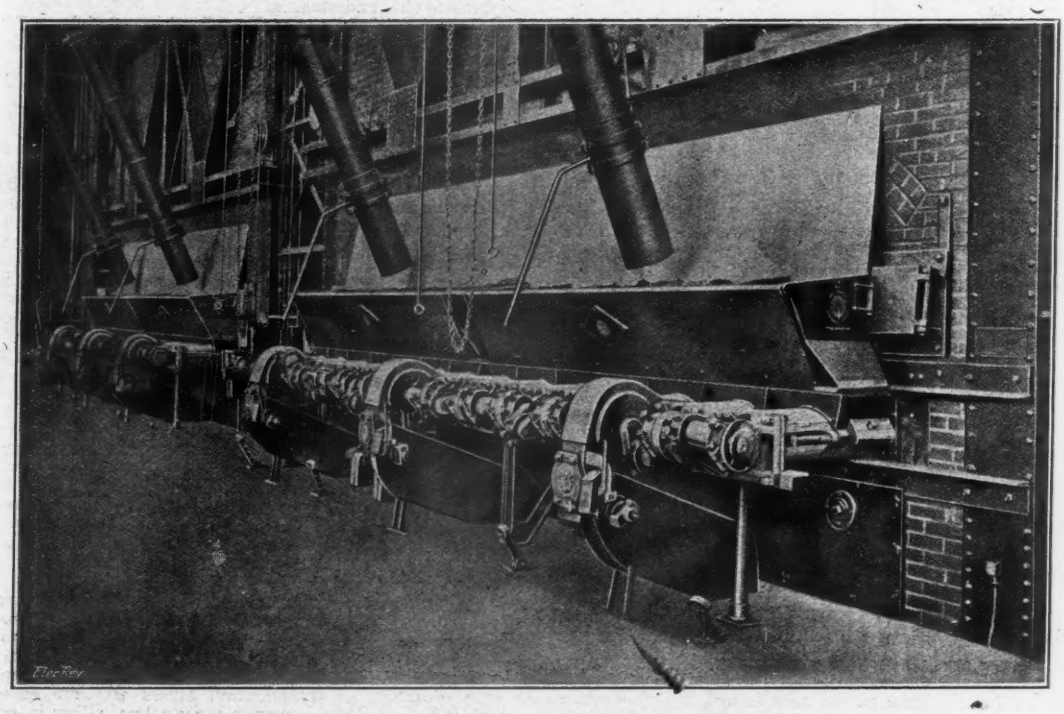
In this way, it becomes entirely practicable to eliminate banked fires, and thereby to save much fuel as well as extra boilers; when the peak load comes on, the stoker and fan are speeded up, and high rates of combustion are very rapidly attained, owing to the very large area of active combustion and the direct radiation from a hot fire to boiler tubes.

The absence of brick arches or partition walls enables the whole furnace area to be fully utilised, and makes it practicable to maintain the highest temperature of combustion.

No grates being used, riddlings are eliminated, and the positive fan draught allows the greatest range in fuels, both as regards size, heat value, volatile constituents, and ash contents; hot semi-bituminous coals, such as Welsh, give excellent results, because the hot zone of combustion is not in contact with metal, but above the middle layer or coking zone; while either clean or dirty bituminous coals are smokelessly burnt.

A very valuable feature is the provision for instantly adjusting the travel of the moving tuyeres within a wide range, so as to suit different classes of coals. In the same way, any individual row of tuyeres can be given a long stroke, independently of the others, so that its ash-pusher will discharge any exceptionally large clinker that may form; the adjustment is external, and the action is fully mechanical, avoiding occasion for hand-poking.

The Erith-Riley stoker is equally adapted to all makes of water-tube boilers, and is constructed in England by Erith's Engineering Co., Ltd., London; in France, by Erith Leroy et Cie., Paris; and in America, by the Sanford Riley Stoker Co., Ltd., of Worcester, Mass



Erith-Riley Stoker Installation; each boiler supplies a 5,000-kw. load.

THE AUSTRALIAN COAL TROUBLE AND ITS EFFECTS.

The Australian newspapers for the end of November, which are just to hand, contain a good deal of information relating to the experiences of electric supply authorities and their consumers consequent upon the coal trouble. Restrictions on gas and electric light and power consumption were made at Melbourne, Sydney, Ballarat, &c. The Electric Light and Power Board, which was set up under an Emergency Act, handled the matter. One paper says:—

"Immediately the orders were issued defining the industries and factories to which electric current is to be supplied the several electric supply companies concerned set about cutting off electricity from those not included in the terms of the regulations. No notifications are being issued to consumers, the practice in operation being simply that the officers of the companies visit the consumers' premises and cut off the fuses. The completion of the full round of consumers to be deprived of their current is expected by the heads of the companies to take considerable time. In this connection they wish to point out emphatically that the onus of discontinuing the use of electricity is thrown absolutely on the consumers. The companies will accept no responsibility if electricity is used in contravention of the regulations. Deprivation of current is, however, being facilitated as a consequence of the meeting of representatives of electrical supply companies, when a list of factories was drawn up and classified according to national utility, and the decision was reached to act uniformly when the regulations were issued."

Another paper says that in view of the space available in big refrigerating chambers, the Electric Light & Power Board

decided that the smaller butcher and other shops utilising public supply of electric power would be deprived of current at noon on Saturday. From the previous Wednesday until then about 100 places with small installations had an opportunity to secure space for their goods in the refrigerating rooms of the City Municipal Cold Storage and other such buildings. The Board sat daily to hear applications. An application was made by one man for power to crush 10 tons of wolfram, which was eventually to go to the British Government. On condition that the wolfram was dispatched from Australia through Dalgety & Co. (British Government buyers) the power was granted.

A telegram was received from the Federal Treasurer asking that a certain contractor might be given electric power to help in the manufacture of a secret ink which is used for paper money. This was granted.

A somewhat similar application from the Commonwealth Bank—for power to operate a paper-money destroying machine—was allowed.

On November 29th, 14 persons were proceeded against, on information that they had suffered electricity generated by the Sydney Municipal Council to be consumed. One of the cases was dismissed, and in the remaining 13 instances fines ranging from £1, with 6s. costs, up to £5, with 6s. costs, were inflicted. Mr. Waldron, the City Solicitor, prosecuted.

The Magistrate (Mr. Macfarlane) said that he did not intend to impose heavy penalties in the cases before him, as he hoped that the prosecutions would act as a warning to other people. In the event of further breaches of the Act he would impose the full penalty of £500.

George Crowley, Wright's Road, Drummoyne, had electric light in the hall and stairway, and also in the billiard-room, on November 23rd. He pleaded guilty, and was fined £3, with 6s. costs.

Dr. Keith Smith said that he had burnt electric light in the hall and surgery of his residence at 7, Duke Street, Kensington, for the purpose of examining a patient who had come in with an injured arm. A fine of £2, with 6s. costs, was imposed.

Dr. N. H. Bridge pleaded ignorance, as he had been too busy to read the newspapers. He was fined £2, with 6s. costs.

One electric light and power company which had taken special precautions to protect itself against strikes, and had stored coal sufficient for three months' supply, protested against its coal being taken by the Government. The directors had no objection to it being taken for the use of transports, munition works, &c., but they emphatically objected to coal being taken from them in order to maintain other undertakings which had not the foresight to conserve a reserve supply.

The strike was settled on November 30th, and concessions were immediately made respecting supply of gas and electricity to factories engaged on war work.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Position of the Shift Engineer After the War.

Mr. John Marks's interesting article ventilates a very important subject, and will interest a wide circle of readers. There is no doubt that, in the near future, a very considerable change in the status and responsibilities of shift engineers will take place; this may, as Mr. Marks believes, be in the direction of a gradual degradation, or it may, as I hope, take the form of a very notable improvement. Broadly speaking, there are two possibilities: either the present era of isolated plants, usually small and circumscribed by municipal boundaries and municipal jealousies, may continue, in which case Mr. Marks's expectation will certainly be fulfilled; or else the numerous petty generating stations of the present time will be superseded by really large centralised plants, which will require an entirely different and improved type of shift engineer.

Let us consider the duties of a present-day shift engineer. In the great majority of cases the principal scene of his activities is the engine-room, an uncertain amount of cursory attention being given to the boiler-house. Now, up-to-date engine-room plant is very reliable, its efficiency depends chiefly upon its design and lay-out, and is only to a very small extent susceptible to improvement at the hands of the running staff; while the boiler-house plant demands very much more than cursory attention if high efficiencies are expected. In these circumstances, the shift engineer feels that he is ineffective, and is often conscious, not only that the engine room offers him but little scope, but that his training, which has frequently been confined to engine-room working, and often, even, to switchboard or sub-station operation, has not qualified him successfully to attempt improvement in the methods of the firemen. Generally, one of two consequences ensues: if he is a good man, and ambitious, he probably does his best to follow Mr. Marks's example and get out of station work altogether, while if he is of a more mediocre type he soon becomes apathetic, and degenerates into little better than a "passenger," whiling away the laggard hours of his shift in the office chair, with his feet on the table, or varying the tedium by occasional more or less aimless walks round the station. There are, of course, bright exceptions who by sheer force of personality rise above their present-day circumstances, and do succeed in making their position one of importance, but they are rare, and their capabilities are not at present realised to the full in central-station employment.

Under the conditions in vogue at the present time, instead of the steam-raising plant being operated under expert technical supervision, which is of the highest importance to secure efficiency, it is left almost entirely to semi-skilled men who in general, however willing and hard-working they may be, lack both the skill and the capacity to understand the problems presented by what is, in reality, a rather delicate chemical operation. In the result, large quantities of coal are wasted which could, and should, be saved. We are led to the conclusion, then, that in the large power stations of the future the shift engineers must be primarily steam-raising experts, and only secondarily electrical men; the "glorified switchboard attendant" type finding his level in the sub-station and mains departments.

As for the contention that supply authorities cannot afford high salaries to such men, I think this is baseless. On a reasonable estimate, 5 per cent. of the coal now used could be saved by the change I have indicated; therefore in a moderately large station burning, say, £2,000 worth of coal weekly, there would be a saving of £100 every week to pay increased salaries out of, which would leave a handsome surplus to the undertaking.

In order to avoid personal applications of these strictures on shift engineers, I hide my identity behind the pseudonym of

Ex-Shifty.

Women Tramway Drivers at Keighley.

I notice in your issue of January 12th an item with reference to women drivers, under the heading of Keighley, in which you state that the Corporation has decided to abandon its experiments of employing women drivers on electric cars. I should like to repudiate this statement, as neither the Tramways Committee nor the Corporation have arrived at any such conclusion. I understand that something of the sort appeared in the *Yorkshire Observer*, but it was put in by some unauthorised person. In fact, we have an idea that the Amalgamated Society of Tramway and Vehicle Workers was responsible for it.

The real position is that very severe weather set in about the time when we started training women for driving work, and we were unable to equip them with suitable clothing to continue under such bad weather conditions. As far as the Corporation are concerned, the matter is now postponed until the severe weather has abated somewhat, and proper garments can be provided.

Harry Webber,
Borough Electrical Engineer & Tramways Manager.
January 15th, 1917.

City and Guilds Examinations.

We noticed your comments on our letter in your issue of 5th inst., and hope you will allow us to reply thereto. We have purposely delayed this reply so as to be able to deal at the same time with any remarks that might emanate from your readers. But, in spite of the importance of the matter, none of the many teachers and others who are concerned with it have had the energy to write a line, either in support or disapproval of our views.

When we stated that electrical installation work was the fundamental electrical engineering subject, we meant, of course, as regards the whole group of applied electrical subjects dealt with in a technical college. Consequently, what you say about manufacture has nothing at all to do with our topic, for manufacturing is not taught in technical colleges.

Your variation of our military metaphor amounts to saying that the electrical officers do all the real fighting work of spreading the applications of electricity. With this, of course, we don't agree.

As regards the construction we have put on the various percentage results quoted, we were quite prepared to find you disagreed, but we should have liked to know exactly how you interpreted them.

Lastly, you do not say whether you agree or disagree with our main contention, that the subject of electrical installation work is grossly neglected at our institutes and polytechnics.

A. P. Lundberg & Sons.

London, N., *January 12th*, 1917.

[It seems clear that we are to some extent at cross purposes with our correspondents; apparently, while we are thinking of the electrical engineering industries as a whole, and the objects and methods of technical training in connection therewith, they are discussing a part of the subject only. The distinction between the respective functions of the technical college and the trade school comes into the question, which is

complicated by the fact that some institutions combine both functions, inclining to the former in the day-time and to the latter in the evening; and the cognate division between technical training in the broader sense and manual training or handicraft instruction is also involved. We agree that electrical manufacturing *as a handicraft* is not, and cannot be, taught in technical colleges, but we maintain that the training given in such colleges is directed mainly to the production of men qualified to take part in the design, manufacture, and erection of electrical plant of every description. On the other hand, in the trade school the actual manipulation of materials and apparatus is the main subject of instruction, together with sufficient explanatory tuition to enable the pupil to understand the reasons for the processes and precautions which he is taught. Of these two divisions, the former is of far greater importance than the latter, for it cultivates the intelligence and lays the foundation for individual initiative far more efficiently than the latter.

As regards the comparative results of the City and Guilds examinations in "Electric Wiremen's Work" and "Electrical Engineering," we consider the respective numbers of students in attendance reasonably proportioned; a smaller proportion of the wiring students present themselves as candidates for examination because they are probably drawn from a class of worker that has no liking for such functions, or for mental effort, but the data for 1916 are undoubtedly affected very materially by the war conditions, which not only reduced the percentage of candidates able to sit for examination, but, by taking away all over 18 years old, reduced the percentage of passes.

We do not consider that the subject of "Electrical Installation Work" is "grossly" neglected; where there is a demand for classes to be held, they are usually provided. It should not be forgotten, either, that Grades I and II in "Electrical Engineering" have a direct bearing on wiremen's work.—EDS. ELEC. REV.]

Books for Soldiers.

I am anxious to know if one of your numerous readers could oblige me with a second-hand text-book on "Storage Batteries and Accumulators."

Prior to enlisting I was employed with an electrical firm, and I was anxious to further my knowledge as regards this subject, but this war terminated the desire, at least, for a while.

Having a little time to spare, when we are not engaged in "strafing" the Turks, I thought I could not be better employed than endeavouring to further this desire of mine, and I thus appeal, through you, to some kind reader who will help me out of my difficulty.

Things are rather slow here at present. The climate is the main thing to contend with, especially in the summer, when all kinds of diseases and fevers are prevalent. Strange to say, we Britishers stick the climate better than the Indian troops. It is very little news we get out here other than that in the *Basrah Times*, a copy of which I enclose, and you will agree that this, even, is very scanty.

I must now close, and tender my best thanks in anticipation to whosoever replies to my request. Wishing yourself and readers a right merry Christmas and a happy New Year.

Sydney James Knight (Corpl.).

Mesopotamia Expeditionary Force,
December 7th, 1916.

[Offers of books on technical subjects generally will be welcome, as we receive many requests for them.—EDS. ELEC. REV.]

WAR ITEMS.

Prohibited Exports.—By an Order in Council, the Customs (Exportation Prohibition) Act, 1914, is amended as follows. The following clause is deleted:—

(C) Telegraphs (except wireless) instruments and material for (not including insulated wires and cables, the exportation of which is prohibited to all ports and destinations abroad other than ports and destinations in British Possessions and Protectorates).

The following heading is added:—

(B) Telegraphs, instruments and material for, the following:—

Wheatstone automatic apparatus:—Automatic transmitting and Wheatstone transmitters.

Parts of Creed apparatus:—Creed engines, Creed relays with pneumatic valves.

Auxiliaries to Creed apparatus:—High-tension keys operated by pneumatic pressure; high-tension keys operated magnetically; Dictaphones and dictaphone cylinders; Einthoven galvanometers; paper tape photographically sensitised.

(C) Telegraphs (except wireless) instruments and material for, not otherwise prohibited.

Munition Work in Switzerland.—The Paris correspondent of the Exchange Telegraph Co. quotes in the *Times* a statement of the Zurich correspondent of the *Journal* regarding German efforts to increase the production of munitions. Very important orders have been placed in Switzerland. "It can be affirmed that a great number of workshops, employing more than 4,000 hands, are working on behalf of the German Government. Captain Schmitz, Attaché to the German Embassy at Berne, is organising the distribution of the work, assisted by the Allgemeine Electrizitäts-Gesellschaft, which is itself carrying on operations under cover of a Swiss company of electric appliances—namely, the Prothos Co. This company, which for the past three months has manifested renewed activity out of all proportion to its antecedents, is erecting an important branch factory at Altstetten, near Zurich, for the manufacture of fuses and grenades for the German military authorities. A single firm at Schaffhausen has delivered to Germany 300 motors for submarines. The Swiss people who are working in these factories are receiving very big salaries, and this constitutes for Germany an excellent means of propaganda. In view, however, of the development of German industry in munitions in Switzerland, the German Government is proposing to send to these factories her own subjects who are residing in Switzerland, in conformity with a special clause in the new law relating to compulsory national service."

Exemption Applications.—At the Falkirk Tribunal, exemption was claimed by an electrical supply company in respect of two linesmen. An agent said the company generated 13 million units per annum, 84 per cent. of which was supplied to works and collieries. There were 40 miles of underground cable. The subjects of the application were skilled linesmen, and their particular duty was the setting up of telegraph poles and binding the wires. They had 75 miles of overhead wire to look after. A representative of the company said that, owing to the shortage of men, they had been engaged on certain work for the past six months which would otherwise have been completed in one month. Both men were granted conditional exemption.

At Ramsbottom, the District Council appealed for the trackless car depôt foreman, single, aged 24. It was stated that he was an electrician, and had charge of the electric sub-station. He had been at the depôt three and a half years, and if he was taken the service of cars could not be continued. Conditional exemption was granted, but the Military Representative gave notice of appeal.

At Blackpool, application was made on behalf of the Tower Co. for a switchboard attendant (27), an electrical engineer (36), and an assistant chief, and an electrical mechanic and clerk of works. The engineer's case was not assented to, and the switchboard attendant's claim was also refused. Temporary exemption was granted to May 31st in the other two cases. The Winter Gardens Co. appealed for an electrician, aged 29, but the claim was refused.

At the Flintshire Tribunal, R. Jones (39), stoker at the Rhyl electricity works, appealed against a refusal of exemption, and was granted three months' exemption.

The Exmouth Tribunal have granted conditional exemption to the following members of the staff at the electric light works:—Mr. F. C. Mann, electrical engineer and manager; J. T. Pyne and S. H. G. Carter, stokers; and C. E. Stott, mainsman.

At Southend-on-Sea, 12 tram drivers were appealed for by the Corporation. Mr. R. Birkett, electrical engineer, stated that efforts to replace the men had failed; they had engaged 28 men as drivers, and 21 had thrown up the job. The Mayor observed that the Corporation must set a good example; it might even happen that the trams would have to shut down. The railways had begun, and the trams might have to follow. The men would be exempted until March 1st, when the cases would be reviewed.

At Dover, on January 10th, Mr. Woodman, borough electrical engineer, appealed for C. C. Bailey (31), collector of electricity charges, &c., and six months were allowed.

At Coventry, an appeal was made by Mr. C. H. Patrick, electric light and power contractor, who is in Class C 3, and is engaged on Class A work for local munition factories. Exemption until May 1st.

An appeal was made at Tredegar for an electrician (30), engaged with the Powell Duffryn Co., Ltd. It transpired that applicant was filling a place vacated by a man who had joined the Army, but it was pointed out that the company were now in want of four electricians. If a substitute could be found the company would take him. A month only was conceded.

Before the Hoylake and West Kirby Tribunal, exemption was sought for an electrical engineer having charge of the plant supplying current to the village of Caldy. Exemption to March 31st was granted.

Exeter Tribunal has reviewed certificates of conditional exemption held by Messrs. A. C. G. Buchanan and A. G. Powell, electrical engineers at the Corporation works, and Mr. L. W. Cornish, assistant mains engineer. It was stated that the conditions remained practically unchanged. Each certificate was cancelled; Messrs. Buchanan and Powell were exempted until May 31st, and Mr. Cornish until March 31st.

At Hitchin, on January 8th, a review was asked for the cases of P. Wilson and A. Dodds, on the Hitchin staff of the Electric Supply Corpn., who had been conditionally exempted on account of their occupation. The local manager (Mr. Laverty) said that the Corporation wished the whole of the applications from their 18 stations to be heard by the City of London Tribunal. The Military Representative objected, say-

ing that the certificates had been obtained locally, and they had been willing to rest on them. He asked what reason had they to fear coming to the Local Tribunal for a review. The Tribunal decided to deal with the cases after the two men had been medically examined and classified.

Before the West Kent Appeal Court, the Military appealed against exemption held by J. S. Newnham (29), the only outside electrical fitter with the Beckenham U.D.C. He had been passed for general service, and he stated that he worked 84 hours per week for a wage of £2 15s. The appeal was successful, and the Court allowed one month, with no further application without leave, a substitute to be found if possible.

At Dewsbury, the Military appealed against a draughtsman with the Yorkshire Electric Power Co. It transpired that at the outbreak of war the man gave up a good position with the Rio Tinto Co., in Spain, to come home and do some work for the country. He asserted that he would now have been in Woolwich Arsenal if the Military Representative had not refused to give him a permit, and he resented the suggestion that he only came home on holiday. Had he stayed in Spain his salary would have been increased by £1 per week. The Tribunal expressed the opinion that his coming home was to the man's credit, and they exempted him as being in a certified occupation.

Messrs. Binney & Son, electrical engineers' furnishers, appealed at Coventry, on January 11th, for exemption for Mr. J. W. Vallis, for 20 years manager of the Coventry business, and passed for garrison service at home. The firm, it was stated, provided supplies for transmission of power to local factories which were being extended, and, in addition, they had to supply from stock in case of breakdowns. Six months' exemption was conceded.

Before the East Kent Appeal Court, on January 8th, Mr. F. J. A. Kingston (33), of Messrs. Kingston & Co., Ltd., electrical engineers, of Margate, appealed against the withdrawal of his certificate of conditional exemption. It was stated that since the outbreak of war the firm had voluntarily granted the use of their X-ray apparatus and instruments for the benefit of wounded soldiers, and applicant had carried out the work. The Military Representative said that the exemption was granted upon the grounds of munition work, but the amount done was so small as not to warrant exemption. The appeal was dismissed.

At Coventry, Mr. W. J. Blomfield (39), electrical engineer, asked for extended exemption, pleading that his work was of national importance. He was a Special Constable, did motor patrol duty, and was passed for general service. He was allowed exemption until April 8th, and was advised in the meantime to use every effort to get someone to take his place.

CAPITAL AND LABOUR.

We have received a copy of a pamphlet containing three addresses delivered respectively at Bolton, Manchester, and Liverpool, in October and November last, by Sir William Lever, Bart. Two of the addresses relate to "Harmonising Capital and Labour" and "Industrial Administration." In the former address, Sir W. H. Lever makes some reference to the prosperity-sharing scheme which has been adopted by Messrs. Lever Bros., of Port Sunlight, and an appendix to the address in the pamphlet gives full details of this scheme. He emphasises the fact that the old false idea that Labour is merely the paid tool of Capital has got to go "bag and baggage." Business is not only the science of the production and distribution of goods, it is also a social science. The so-called "practical" business man, ostrich-like, buries his head in his ledger and ignores the writing on the wall. Labour as a human element in production and distribution has not been scientifically analysed as Capital has been for the guidance of Capital. The workman is no longer a "hand," he is an educated man, and his wants are growing and his outlook extending. "Cannot Capital and Labour," he asks, "after having fought and died side by side in the trenches of Flanders and France, be won over to fight for the success of our Empire industrially after the final war victory?" Too long has there existed a wide gulf between Capital and Labour; for too long have suspicion and distrust produced active opposition between these twin brothers in productive enterprise. The claim of Capital for as big an output as possible at as low a cost as possible has hitherto had to pull against the claims and aims of Labour for as high wages as possible with as restricted an output as possible. The new lesson for the capitalist is that high wages, short hours, and good healthy conditions, by increasing intelligence and efficiency, increase output and actually reduce costs; while the new lesson for Labour is that increased output stimulates consumption and, consequently, demand for production and distributive labour, the fact being that consumers of all classes supply themselves where they can be best and most economically served. Labour, however, will not be brought to work side by side with, and to harmonise with, Capital merely by ever higher and higher wages, shorter and shorter hours, combined with better and better welfare conditions. Only by entrance into co-partnership together can the twin brothers be brought to pull in one direction.

If high wages, short hours, and good housing meant finality to Labour unrest, the labourer would not be a man, but a vegetable. For one thing, a ladder must be provided from the humblest position in industrial organisation to a seat on the board of directors—Labour must have a share in management; for the other, Capital and Labour must both be provided with the same outlook by dividing the profits their joint labour has created, fairly and squarely between them. On this system each will also automatically share and suffer from losses when they have to be faced, and consequently become more interested in the policy of the business as a whole, and associate themselves more and more with careful and skilled management. With co-partnership, the spirit of greed cannot intrude between Capital and Labour. Co-partnership can only fail when Capital or Labour expect too much as a result of it, and where Labour, after being taken into co-partnership is not treated as a partner. Capital must not expect that Labour after co-partnership will cease to make demands for higher wages, or relinquish its right to combine in Trade Unions; and equally, co-partnership must not be shipwrecked by Labour expecting that Capital shall cease to fill its function of control and maintenance of discipline. Co-partnership means much more than sharing profits as an addition to wages. It means that spirit of comradeship; the spirit that recognises equality and brotherhood.

Dealing with "Industrial Administration," Sir William affirms that the biggest problem the employer has to face, and one that is always present with him, is to surround himself with a permanent efficient staff, happy and contented in their employment, who will not only work *for* him, but, what is much more valuable, will work *with* him. To ensure this, it is absolutely essential to convince the employé working for a salary or wages that the welfare of the employer and employé are identical. The chief basic principle of industrial administration is increased production—with consequent reduction of overhead charges and reduced operating costs—combined with shorter hours for workers, the whole resulting in better working conditions, greater efficiency, higher wages, and better profits. The workman to-day claims rights, and does not deny that the exercise of rights will bring with it the responsibility for the performance of duties, and these duties he is willing to undertake. Of course, we must have authority and law, and due observance of discipline in the factory and workshop, as on the steamship, and as for the nation and State. The question is: has the authority to be autocratic or democratic?

Scientific administration will make clear that restriction of output is not only immoral for the man who might have made two articles but who only made one, and who has thus robbed his fellow-man even more wickedly than the thief who had stolen one out of any two articles one of his fellowmen might have made; for whilst, in the case of the robber, there would still be the two articles, and both would be of service, there would be only one article in the case of restriction of output, and the lapse in production could never be made good.

Parliament has passed Industrial Acts preventing the thraldom of Labour; it may also be forced to pass laws to prevent restriction of output as an act of robbery against the common weal. Industrial administration, by providing the means for intensive mechanical production by increased steam power and more efficient plant and machinery, demanding less and less exhaustive strain on the employés, has unlimited opportunity for increased output at reduced cost after paying the highest world's scale for wages; and this can all be accomplished provided the falsehood of restriction of output is not permitted to spoil the working of these economic principles.

Mechanical utilities, mechanical horse-power, and standardisation of products, are the keystone of the arch of better conditions for employer, and still more so of better conditions for employé. High wages cannot be paid without correspondingly increased output by employés. The lowest output, and the longest working hours per wage-earner in the world, are to be found in China and India; and in these countries there is also the lowest mechanical horse-power per wage earner, and the lowest wages earned per wage-earner. The example of the highest of all these will be found in the United States. The mechanical horse-power per wage-earner in the United States is two or three times that per wage-earner in the British Isles, and the output is also two or three times that of the British Isles; but the wages in the highly-skilled trades in the U.S.A. are over four times per wage-earner of those paid in the British Isles, and even in the less skilled trades over three times.

Sir William proceeds to prove by pre-war statistical tables that in the U.S.A., by increased mechanical horse-power combined with increased output the cost of coal to the consumer has been reduced, and the employers have been enabled to pay more than two or three times the rate of wages per wage-earner in mines, as in all other industries in the U.S.A. than can be paid in the British Isles. Whether this is owing to the "ca' canny" or other restriction policy adopted in the coal industry in England or not, Sir William does not presume to say. The tragedy of it is that it makes the cost of cooking, heating, and lighting oppressive for the wage-earner, and creates a handicap to every British industry that uses coal, making the cost of production of all articles higher. It threatens our iron and steel industries, and with them our world supremacy in shipbuilding and our mercan-

tile marine, upon which we absolutely depend for our very existence as a nation. The first of all false policies to be scrapped by Trade Unions ought to be that of restriction of output. Sir William Lever concludes that in the after-war struggle for industrial position, defeat is certain if our industrial organisation is founded on attempted oppression of Labour on the one hand, or restriction of output by Labour on the other.

ELECTROMOBILE EXPERIENCE.

By R. BORLASE MATTHEWS, Wh.Ex., M.I.E.E., A.M.I.C.E.

Many cart and delivery-van owners are now seriously considering the employment of electric vehicles, and are, therefore, greatly interested in what others are doing, and have done, in this field. Accordingly, some particulars gleaned from the lengthy experience extending over some 15 years of a very large garage will, doubtless, be welcome at the present time. It will be news to many to learn that as many as 120 electric vehicles are housed and maintained by the Hertford Street Motor Co., Ltd. (incorporating the Electromobile Co.). Further, it is of interest that all the cars are British built, with British batteries.

Long Life.—A visitor to the large Mayfair garage of this enterprising undertaking will have a very practical demonstration of the long life to be anticipated from an electric chassis. This firm still has in daily running, side by side with modern cars, vehicles that first began their career 10, 11, and even 12 years ago. May one be permitted to ask: Where are the petrol vehicles of a decade past? It would be better to draw the veil than to press for the reply.

Advantages of the Electric.—Some years ago the Automobile Club held a test for town motor cars, and the Electromobile was awarded first place and a gold medal for (*a*) general design of a complete car; (*b*) absence of noise with car stationary or running; (*c*) absence of smell and smoke; (*d*) absence of leakage of lubricant; (*e*) absence of vibration with car stationary or running; (*f*) smoothness of running and comfort of passengers; (*g*) ease of access for repairs; (*h*) ease of starting; (*i*) ease of stopping and speed changing without jerks and noise; (*j*) ease of manœuvring. Quite the most humorous and, at the same time, convincing feature of this competition, was that the Electromobiles entered, instead of being brand new cars, had previously run over 20,000 miles. Again the question arises: Whatever chance would a petrol car stand in a competition of this nature after such a mileage? It would be a mere farce to enter such a be-travelled petrol vehicle. The above are, of course, features inherent in electric vehicles generally, and they are very valuable advantages, for if, as is the case, they can be obtained commercially, they are ideal.

Care of Batteries.—While the principal business of the company is the hiring-out of high-class private carriages, cars are also garaged on the premises, and batteries belonging to a number of private owners are charged and maintained. In addition, the company especially caters for the maintenance and charging of batteries for commercial vehicles. Users of electric vehicles who would like to have the whole responsibility of the care of their batteries taken off their shoulders, could not do better than make an arrangement with such a company as this. If, however, they own a sufficient number of vehicles, they should inaugurate a battery maintenance system along similar lines. This would result in a longer life for their batteries, though it must be admitted that even where unskilled labour is employed, the length of life has been proved to be quite satisfactory. A company such as the above excels in the organisation of the battery maintenance system, and, where economy to the absolute limit is a consideration, this point is of the utmost importance.

Battery Life.—In accordance with this company's experience in the case of ordinary lead battery plates, a distance run of 4,000 to 5,000 miles should be expected from the negative plates. With modern lead-plate batteries and proper attention to charging, considerably greater length of life is obtained. As a result of the care and attention given to their batteries—notwithstanding the rough conditions of road usage to which the batteries are subjected—the above mileages are often greatly exceeded.

Interchangeable Batteries.—A very special and important characteristic of the company's system of operation is the fact that no battery is allocated to any car, but that the batteries are all interchangeable and are always charged off the car. This means the maintenance of a very close supervision over the batteries. When a car is ready to leave the garage, it is supplied with a freshly-charged battery of suitable mileage capacity for the journey to be undertaken. If boosting is required during the course of the day, this is done while the battery is on the car. Boosting, however, is an unusual practice where this firm is concerned, as the ordinary battery plates that it employs last better under normal conditions of discharge. Further, it is so easy to put a fresh battery in place, that that may just as well be done as to give a boosting charge. Where exceptionally long distances have to be covered, or where time is not so pressing, as is the case with many commercial vehicles which have to spend some hours loading up and discharging, boosting is of great value, and several types of modern batteries are well adapted to it, much more so, in fact, than those equipped with the ordinary form of plate.

Value of Good Discharging.—Experience has shown this company that there is nothing so good for a battery as to be well discharged before recharging. A voltage when discharged of 1·8 per cell when tested on a closed circuit, is that which they find the preferable point at which recharging should take place. If the voltage is either higher or lower, it is not so good for the life of the cells. However, under practical conditions of working, this ideal cannot be obtained as often as desired. Instructions are given to the drivers to crawl home at an economical speed, as soon as they notice the voltage falling off seriously, and even then a battery occasionally gets discharged to too low a point.

Battery Ills.—Prospective battery troubles are a bogey to many would-be users. Nevertheless, these difficulties do not occur with the modern lead-plate battery as they used to do with the older types employed in electric vehicle practice of a few years ago. Injurious sulphating is a trouble unknown to this company, for, as one will be told with a smile, their batteries are too hard-worked to suffer from an ailment due more to standing idle than anything else. Evidently the moral is to use one's batteries constantly. Inquiries as to other battery ailments elicited the fact that, with their careful supervision, very little ever went wrong, and that it was outside their experience ever to get hung up on the road through the fault of a battery. A great deal of care is taken to ensure the use of the best acid, fresh distilled water, and the purest of materials generally, thereby eliminating entirely many a battery trouble. Of course, in the case of bad conditions of discharge, or of considerable over-discharge, as must occasionally happen in in a business where the distance a car will have to run is often not known on setting out, reversal of plates in a single cell may occur. Now and then an individual cell may fail, but this would always be noticed in the charging room by the low maximum voltage obtained. Such a battery would be transferred immediately to the testing department—a great advantage of interchangeable batteries. When the faulty cell is discovered, a special test is made by the aid of a cadmium electrode and a low-reading voltmeter to ascertain whether the positive or negative plates are at fault. Moreover, an inspection of the record card which accompanies each battery, and gives details of its performance, will always give an indication as to whether or not there is any likelihood of trouble.

Over-charging.—Over-charging, too high a rate of charging, excessive gassing, and similar troubles are avoided as a result of the system employed for charging, which includes the fact that the men responsible are fully experienced, and do nothing else. Further, all the charging apparatus is particularly designed for doing this special work. For instance, as the result of experience, the seven-point charging resistance is so proportioned as to give suitable gradations, which would not be obtained with equal steps or divisions.

Since the batteries are always charged away from the the cars by properly-qualified men, there is no need to fit

on each vehicle an ampere-hour meter with differential winding (to allow for the inefficiency of the battery on discharge) and an automatic cut-out. Naturally, it is usually advisable to equip ordinary lead-plate battery vehicles with such an instrument, where such full attention cannot be given to the charging operation. All the cars are equipped with a voltmeter and an ammeter in a combined case, also an odometer or mileage recorder.

Operating System.—When a car is about to leave the garage, it is run over a small battery lift in the floor, on which a trolley is brought up from the basement carrying a freshly-charged battery. Here is a striking example of one of the systematic details adopted for keeping a record of the performance of the batteries, for with the fresh battery is a card having ready inserted upon it the number of the battery and the charging data—which comprise the duration, rate, input in ampere-hours, and potential difference at the end of charge (on closed and open circuit). Before the carriage leaves, its number is entered on the same card, also the odometer reading and general particulars as to date, hour, driver's name, user, &c. On the return of the carriage, the odometer reading is again recorded, also the difference, giving the total mileage, together with the time of return. The battery is then taken down to the battery room, and a test is made of the voltage after running, on open and closed circuits respectively. Should a charge be taken when away from the garage, particulars are entered on the back of the card. Naturally, the battery would not be removed from the car unless not less than about 35 miles had been travelled, or unless the remaining charge was insufficient for the next run.

The information on the battery card is entered up in the record books and further analysed for ampere-hours per mile and watt-hours per mile, &c. Separate records are kept of the mileage of the negative and positive plates respectively.

Battery Details.—When a battery with ordinary lead plates has travelled about one thousand miles, the collected sediment in the bottom is cleaned out. This is considerably oftener than is the custom of some other battery users, who either let it run more like 2,000 miles before cleaning, or else, if the design of the vehicle permits, use cells that have sufficient sediment space to permit running for the full life of the plates. However, with the facilities at this garage, and with the limited space available on the standard vehicles for the batteries, no doubt the practice they adopt is very sound, as the risk of short-circuiting the bottoms of the battery-plates is rendered very much less. Half-an-inch is provided in the standard batteries used by the Hertford Street Motor Co. for sediment space. Each battery has 45 cells, arranged 9 × 5, with 17 plates per cell, the thickness of the plates varying from 3 to 4 mm., according to the make. The rating is 150 ampere-hours at 30-ampere rate of discharge. When new, the batteries have a capacity of about 40 miles on the average car without boosting. As a battery gets towards the time when replating is necessary, the mileage falls off to about 25 miles per charge. Under the latter condition the batteries are very useful for short runs, or the completion of a day's work. Perforated ebonite separators are employed between the plates instead of wood, as they have been found to give every satisfaction as regards circulation, and have a very long life. The company exercise a very catholic opinion as to make of plates, which they purchase separately, for building into their own batteries, not necessarily getting the positive and negative plates from the same manufacturer. Also, they occasionally purchase the plates ready formed, and sometimes unformed. In the latter case they have to be formed on the premises, a special space in the battery-charging department being allocated for this purpose.

Car Particulars.—In the modern chassis employed by this concern there is very little to get out of order. Ball bearings are employed throughout, even on the motor, so as to reduce friction to a minimum. The wheels are fitted with pneumatic tires, and 4,000 miles is considered as the minimum normal life of a studded tire, which is far better than is normally obtained on a petrol vehicle. All parts are made interchangeable, even the armatures and field coils of the motors. One 8-H.P., 1,500-R.P.M. motor is employed on each car. As the motor has a double commutator, a series-parallel control at constant voltage is obtained, as is done in the case of an ordinary tramcar equipment. The commutator or speed controller is of very simple design, operated by a small lever under and concentric with the steering wheel. No breaking of the circuit with resultant sparking takes place on the commutator, as the main switch (which is fitted with a magnetic blow-out) is opened for each change of speed by a foot lever, and the latter is also connected to a mechanical brake. In addition to the foot brake, two electric braking positions are provided on the controller. The motor drives the differential through double-reduction double-helical gearing. The efficiency of the motor is 80 to 87 per cent. The standard chassis has a wheel base of 7 ft. 6 in., with a track of 4 ft. 6 in., and weighs 9½ cwt. without the battery, and the latter turns the scale at 11 cwt.

Garage Arrangement.—It is of historical interest to note that the garage is erected on the site of the once far-famed Mayfair Ducking Pond. It covers an area of half an acre, with a total floor space of two acres, comprised in a basement, ground and first floors, and a flat asphalted roof. The structure is carefully designed and fireproof. Large hydraulic lifts are employed for handling the cars, and two small ones for the batteries. The east bay of the basement is devoted to mechanical repairs on the chassis and the body; while the central and west bays are set apart for the battery charging, cell forming, and maintenance departments. The dynamo room is also situated in the basement. The ground floor is, of course, chiefly occupied by the vehicles in use; the electric batteries are attached or detached to or from the cars on this floor by the aid of two lifts from the basement below. The offices, together with handsome reception and waiting rooms, are also here. A separate department is provided for the tire storage and repairing and vulcanising plant, &c. For, similarly to the batteries, the tires get very careful attention. Compressed air is laid on through the building wherever accessible by cars, so there is no excuse for not properly inflating the tires. The second floor is utilised for storage, coach-work repairs, repainting, upholstering, &c.

The dynamo room is equipped with two 90-KW., one 118-KW., and one 130-KW. motor-generator sets, to reduce the supply voltage as received from the Westminster Electric Supply Corporation at 400 volts to 113 volts, which is the standard for the garage. The annual consumption of energy is something like half a million units.

Costs.—The average cost of current for running does not exceed that of modern electric passenger-car practice, as over two car-miles per unit is obtained. This is obtained, inclusive of the loss of transformation in the motor-generators from the 400-volt mains to the 113-volt charging supply, and hence is an indication of the very cheap cost of operating electric vehicles as far as power is concerned. The cost per car-mile of plates and maintenance is less than that of the tires. This indicates that electric vehicle operation is a sound commercial proposition that offers very considerable advantages over petrol or horse-traction systems, provided the mileage does not exceed that of the capacity of a single battery, or, alternatively, that facilities are provided for picking up other ready-charged batteries as required. The present difficulties in the way of the latter arrangement will prevent electric vehicles from competing with petrol-driven cars on the longer distances, for if the weight of the battery were increased beyond that which has been found to be the economical weight, there would be the serious drawback of having to haul about non-earning deadweight.

In Conclusion.—The writer wishes to express his indebtedness for the courtesies extended to him, in his quest for information, by the management of the company, and in particular to Mr. W. H. Hixson, the chief electrical engineer and works manager, who personally took a great deal of trouble in explaining the details of the methods, organisation, and system adopted and so thoroughly worked out by this company. Their carefully-kept records and statistics afford extremely valuable information, of which they have taken full advantage, with the result that they can probably run an electric vehicle more economically than anyone else.

BUSINESS NOTES.

Book Notices—We have received a copy of the special January number of the *British Trade Review* (113, Cannon Street, E.C.). We are informed that the *Review*, which in the past has circulated almost exclusively abroad with the object of encouraging our overseas trade, is now to open its subscription list to United Kingdom manufacturers. The issue before us is a very bulky one, and its editorial matter necessarily covers a host of subjects in view of the breadth of its title. Some of the special articles are: The Financing of Trade after the War; Catalogues as Salesmen; British Aeroplane Industry in 1916; Electrical Progress in 1916; The Paper Trade in 1916; The Metal Market in 1916. There are many reports on the state of markets in different parts of the country, and altogether the number forms a very useful and businesslike review of the numerous and important trade matters that are now interesting a far wider circle than formerly.

We have received a "special number" of the new *Revue Générale de l'Electricité*, containing the programme mapped out by its founders, from the pen of M. André Blondel, who has been for 25 years associated with *La Lumière Electrique*, and was largely instrumental in bringing about the fusion of the two journals, which now appear united under one cover. M. J. Blondin, who was editor-in-chief of *La Lumière Electrique* from 1895 to 1902, and founder of *La Revue Electrique* in 1904, shares with M. J. de Soucy the office of editors-in-chief of the *Revue Générale*, and an article over their joint signatures outlines their plans for the realisation of the project, while the remainder of the issue sets forth the system of classification which has been adopted, the membership of the administrative council and the editing committee, and the list of shareholders.

The first number of the paper has also come to hand, containing a number of articles by men of eminence in scientific, technical, and legal circles, as well as the fortnightly *Bulletin* of the Union des Syndicats de l'Electricité, of which the journal, in succession to *La Revue Electrique*, is the official organ. We offer our hearty congratulations to our *confrères* on the impressive make-up of their new paper, which not only embodies the realisation of some features of their ambitious programme, but also gives every reason to anticipate for it a successful future. The *Revue Générale* will appear weekly, the annual subscription outside France being 50 fr.

"*Journal* of the Institution of Electrical Engineers." Vol. LV. No. 262. January, 1917. This issue contains the following papers and lecture:—"Parallel Operation of Electric Power Stations," by Mr. J. S. Peck; "Colonial Telegraphs and Telephones," by Mr. R. W. Weightman; lecture to Newcastle Local Section by Mr. H. W. Clothier.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVI. No. 1. January, 1917. New York: The Institute. Price $1.

"Memoirs of the College of Science." Kyoto Imperial University. Vol. I. Nos. 8, 9, and 10. Kyoto: The College of Science.

"Practical Electrician's Pocket Book and Diary, 1917." London: S. Rentell & Co. Price 1s. 6d. net.

Catalogues and Lists.—MESSRS. TAYLOR, TAYLOR, AND HOBSON, LTD., 62, Oxford Street, London, W.—Pocket booklet giving particulars and prices of their engraving machines for engraving on brass, iron, steel, &c.

PIRELLI-GENERAL CABLE WORKS, LTD., 144, Queen Victoria Street, London, E.C.—28-page illustrated brochure, giving an account of the origin of the undertaking at Southampton, which rests upon the universal reputation of two well-known Italian and British electrical companies who, in co-operation, have been able to equip the works on the most modern, and therefore the most efficient, lines. Notes on a tour round the works are illustrated by views of different departments. Excellent and interesting photographic pictures are included of the Southampton works, the Pirelli Italian and Spanish factories, and some of the factories of the General Electric Co., Ltd., in England.

Calendars.—MESSRS. AUSTIN WALTERS & SON, of Gaythorn Electric Works, Manchester, have sent us a calendar for 1917, with monthly sheets with bold black date figuring.

MESSRS. STEWARTS & LLOYDS, LTD., have sent us one of their neat white and gold framed calendars for 1917.

The Value of Good Lighting.—In a pamphlet recently issued by the WESTINGHOUSE COOPER HEWITT CO., LTD., Mr. A. S. Hubbard demonstrates the importance of illumination as a factor in manufacturing costs by an ingenious argument, showing how the loss of a few minutes' working time costs an employer more than would provide a workman with a good light all day. He proceeds to discuss the connection of good lighting with efficiency of labour, and defines the optimum conditions giving the maximum distinctness of vision with the minimum of glare and irregularity. For the mercury vapour lamp it is claimed that its bluish-green light affords greatly increased acuity of vision and diminishes fatigue, and where colour values as they appear in daylight need not be distinguished, this lamp, with its low intrinsic brilliancy and high efficiency, is recommended as the best substitute for daylight in workshops.

Patent Restoration.—Application has been made for the restoration of Patent No. 25,008 of 1911, entitled "Improvements in and relating to indicating mechanism applicable to meters," granted to T. F. & H. T. Thorp.

Factory Property in 1916.—MESSRS. LEOPOLD FARMER AND SONS, London, E.C., have issued their report on factory and commercial property sales during 1916. They state that the sales and letting of factory property, wharves, land, &c., show far better results than was the case in 1915. "This result is, in a large measure, due to the war, which has produced a great demand for factories and commercial property of all descriptions. . . . We have disposed of a large number of factories, with and without plant and machinery, at figures running into many thousands of pounds, and an unprecedented demand still exists for properties of all kinds. Premises that previous to the war had failed to find tenants for years have been rapidly taken up, owners in many cases having obtained, through competition, increased prices to those asked." Many factories have been disposed of to the Government, Government contractors in all branches of manufacture, English firms starting to manufacture goods previously imported (now barred through the war), and Belgian manufacturers who largely exported goods to this country, but are prevented from doing so now owing to their works having been destroyed by the Germans.

"To say the industrial world of England is busy, is a mild term to use; it is in the throes of a boom, and, so far as one can judge, is likely to be for some years to come."

The outlook for further deals in factory property is good, and the firm hope to report a continuance of the demand and supply of commercial properties of all descriptions in the present year.

Trade Review.—MESSRS. BOLLING & LOWE have issued their annualreview of the iron and steel trades for 1917.

Trade with China.—Mr. Archibald Rose, H.M. Assistant Commercial Attaché at Shanghai, is now in this country. He is prepared, by appointment, to give interviews to representatives of British firms, and especially to answer any questions that they may desire to put to him concerning (1) methods of trade in China; (2) appointment of agents; (3) extent of Japanese competition. Applications should be addressed to the Comptroller-General, Department of Commercial Intelligence, 73, Basinghall Street, London, E.C., not later than January 25th in the case of firms in the provinces and February 1st in the case of London.

Liquidations.—SCHOEN BROS., 29-30, Cock Lane, Snow Hill, London, E.C.—The Controller, Mr. J. W. Barrett, has applied to the B. of T. for his release.

STOLZ ELECTROPHONE CO. (1913), LTD., London, E.C.—Liquidator released January 8th.

Bankruptcy Proceedings.—C. B. OGILVIE, electrical engineer, Whalley Range.—First meeting January 24th; public examination February 6th, the former at Manchester and the latter at Salford.

LIGHTING AND POWER NOTES.

Argentina.—The town of Dolores (Province of Buenos Ayres) has been in darkness since December 1st, when the local electric lighting company cut off the current owing to non-payment by the municipal authorities of the public lighting bill.—*Review of the River Plate.*

Australia.—At a recent sitting of the Royal Commission appointed to inquire into the admistration of the work at the Federal Capital, Mr. J. Bethel, the chief storekeeper of the Metropolitan Board of Works, who had been instructed to inspect and value the plant and material in hand, stated that a large and valuable stock of electrical materials was lying at the depôt. Much of it had been kept in hand for a considerable time. No record was kept of it when used, the men taking what they required without check of any kind. Of 94 electric motors there 23 were lying disused, and 36 were in temporary use. Much of the present material lying in the store and yards would never have been ordered if a proper system had been in vogue. He found five motor-cars there, valued at £1,330, and two motor-cycles.

In reporting on the Brunswick (Vic.) electric lighting system, Mr. N. Murray stated that the installation has cost £33,000 to date. While Brunswick was considered the most extensively lighted suburb, the cost was stated to be about 25 per cent. greater by the series system than with the parallel system. The high-tension circuit throughout the city is considered to be a decided hazard to life and property.—*Melbourne Age.*

The Sydney City Council has accepted a tender for the erection of a sub-station in Castlereagh Street, at a cost of £21,000. The front portion of the premises will be utilised as showrooms for electrical fittings, motors, and also electrically-driven motor-cars.

The Council is about to proceed with the erection of a nine-storey building in Kent Street for stores and workshops.—*Sydney Telegraph.*

Ayrshire.—The Troon T.C. has decided to ask Kilmarnock Corporation, which desired to erect an overhead transmission to a new hosiery factory, to lay the cable underground.

Bedford.—PLANT EXTENSIONS.—With reference to the scheme of extension recently put forward by the Electricity Committee, and rejected by the Council (see last week's notes), as a result of the interview of the Special Committee appointed to

secure better terms for the proposed supply outside the borough, the consumer has agreed to raise the minimum guarantee to £3,250 per annum for seven years, and, if necessary, to take current, if required, from the Corporation for the period of the loan. Similar rates to those in the borough are to be charged. These concessions are far less than the demands of the Special Committee, and, the *Bedfordshire Times* remarks, do not amount to very much in reality; however, the resolution to adopt the revised agreement and proceed with the extensions was carried unanimously, and negotiations are to be commenced for obtaining a loan. As we understand it, the undertaking requires the addition of modern generating plant, and the authority behind the new consumer outside the boundary will ensure that the new plant, which would otherwise be difficult to obtain, will be secured.

Bradford.—The Parliamentary Sub-Committee of the Corporation has decided, we understand, to oppose the Electrical Distribution of Yorkshire, Ltd., in the provisional orders which it is asking for from the B. of T. to supply several West Riding districts. Bradford is primarily concerned about the districts of Clayton, Queensbury, Rawdon, and Yeadon, and as these come into the areas for which powers are being sought, it may be expected that strenuous opposition will be forthcoming when the application is heard.

Cardiff.—Year's Working.—The accounts for the year's working of the Corporation electricity department for the year ended March 31st last show a total revenue of £67,842, works costs amounting to £38,931, and a gross profit of £28,911; interest and sinking fund, &c., absorbed £19,544, and the net profit was £9,367. The units sold amounted to 7,452,034, an increase of 129,822 units over the previous year; the consumers numbered 4,108; 1,031 motors, totalling 6,574 H.P., were connected. The maximum load was 4,208 KW. and load factor 20·21 per cent. 2,730,906 units were used for power supply purposes during the year, an increase over the previous year of 171,390 units. Supplies for domestic purposes, particularly for heating, show a steady improvement, the output on this account being 394,504 units as compared with 259,992 units for 1915. The total connections for heating installations at March 31st, 1916, represented 1,194·08 KW., an increase of 315·76 KW. on the previous March figures.

Carlisle.—Proposed Plant Extension.—The Corporation has decided to apply for permission to install additional generating plant, at a cost of £9,000.

Chile.—Permission has been granted to Don Martin Pizarro to install an overhead electric lighting system in the town of Pozo de Almonte.—*Board of Trade Journal.*

Epsom and Wimbledon.—E.L. Proposals.—At the last meeting of the Surrey County Council, the Parliamentary Committee reported in regard to Electric Lighting Orders promoted by the Epsom and Wimbledon authorities, that the Committee proposed to make representations to the B. of T. that, in view of the general questions relating to the supply of electric energy raised by the two London Electric Supply Bills, which will be revived after the war, it is not expedient that any new powers should be granted or vested interests acquired until such questions are settled; also that the time is inopportune for the consideration by Parliament of proposals which must involve the raising of new or additional capital. The report, which was vigorously opposed by the two Wimbledon representatives, was carried with three dissentients.

Featherstone.—Prov. Order.—The Urban Council has decided not to oppose the application of the Electrical Distribution of Yorkshire, Ltd., for a prov. order in the Council's district.

Grimsby.—Women Labour.—At the last meeting of the Corporation Lighting Committee it was reported that some 35 unskilled and semi-skilled employés of the electricity department had been debadged; the Committee decided to employ women and girls to replace men wherever possible inside the works, and to release the others as quickly as substitutes were found.

A scheme was also approved by which the Corporation and the G.C. Railway Co. could either, in emergency, supply the other with electricity in bulk to a certain amount at fixed rates.

Halifax.—Annual Report.—The year's working of the Corporation electricity department to March 31st last shows a total revenue of £71,766; working expenses amounting to £36,051, and a gross profit of £35,715; after providing for interest, income-tax, and sinking fund charges, £20,765, there was a net balance of £14,949, which was carried to the appropriation account, from which £3,345 was transferred for the relief of rates and £3,857 to the renewals fund, the remainder being spent on capital account, &c.

A total of 13¼ million units were sold; we note that the net amount transferred in aid of rates during the last 16 years amounts to £35,294.

Morley.—An explosion of an electric switch box, last week, is believed to have been caused by gas which had made its way into the box from an adjoining main.

Paraguay.—On December 11th a general strike, declared by the Paraguayan Regional Workmen's Union, commenced in the capital. The tramway service stopped during the morning, and in the afternoon the power house ceased operation, owing to the employés having left to join the strikers; the railway staff also joined the movement. During the day the inmates of the public prisons, accompanied by the police, were taken to the power house to assist in the working of the plant, in order to provide lighting for the city. The President of the Republic intervened to bring the strike to a conclusion.—*Review of the River Plate.*

South Africa.—The Cape Town Corporation has been considering the question of placing a limit upon the amount to be contributed in aid of rates by the electricity undertaking, and has decided that the contribution should be at the rate of 3 per cent. on the capital invested; any surplus over this sum to be utilised for reducing the charges made for electricity to consumers. According to the estimates, an excess profit is anticipated this year, but the Corporation has decided, owing to the abnormal conditions, not to make any reductions in the charges at present.

Messrs. Merz & McLellan have been asked to undertake an investigation into the financial position of the Durban Corporation's electrical undertaking. The circumstances under which this arrangement has been made are indicated in a report of the Corporation, which stated that last July the necessary documents should be forwarded to the London agents. The references were:—

(*a*) Whether the plant of the electrical undertaking is worth the amount of the liability placed upon it.

(*b*) Whether the provision out of revenue for depreciation and renewals has been sufficient; and

(*c*) On what basis should depreciation and renewals allowances be made in future.

(*d*) Are all the tariffs in force by the department for the supply of current profitable to the department, and if not, what suggestions as to their alteration could be made?

(*e*) What is the lowest price at which power could be sold, keeping in mind the cost of production, capital expenditure, &c.?

Southend-on-Sea.—Proposed Plant Extension.—The engineer has been instructed to inquire as to the cost, &c., of two 750-KW. generating sets, which will be required to meet future demands; also as to the possibility of enlarging the existing condenser.

Stretford.—It was reported at the last meeting of the Council that, owing to the exceptionally heavy demand for current, the coal consumption had gone up to 280 tons per week, necessitating taking coal out of stock, as the deliveries only average 220 tons per week. At present it was possible to deal satisfactorily with the load, but consideration would have to be given before granting increased supplies.

Swansea.—The electrical engineer has reported that a water-tube boiler, with auxiliaries, induced-draught fan, and feed pump, should be installed at the station as soon as possible. The engineer has suggested that certain of the Corporation houses on the Trewyddfa Common might be dealt with under the scheme of free-wiring, and the Electric Lighting Committee and the Housing Committee have approved of this suggestion.

Tasmania.—Hydro-Electric Plant Extension.—Additional plant is to be installed at the Lady Margaret hydro-electric station of the Mount Lyell Mining Co.; the power at present available is about 5,000 H.P., which is to be raised to 6,600 H.P. The cost is estimated at £30,000. The utilisation of the full resources of the lake is contemplated at a further cost of £30,000, making £60,000; the power then available would approximate 10,000 H.P.

Two working methods for the extraction of sulphur from pyrites prior to smelting have been elaborated by the experts of the Mount Lyell Co. One is the liberation of the sulphur in a closed retort furnace externally heated by means of the electric current. The other consists in the employment of a modern circular reverberatory furnace, mechanically rabbled, built to exclude the admission of air, and coal fired. No difficulty is experienced in either case in driving off the sulphur, but it is necessary to devise permanently effective mechanical means of stirring the ore under the novel conditions obtaining, for which there is no precedent. The low cost of the electric current seems to favour the commercial application of the first-mentioned type of furnace. The attempt to recover sulphur from the furnace gases has been given up as uncommercial.

Whitehaven.—The Water and Lighting Committee of the T.C. is to consider the desirability of extending the electricity mains to Kells, authority for which has been received.

Worcester.—Extension Scheme.—The Council has confirmed the Sub-Committee's action in connection with an increased supply to a local firm, and that steps be taken to secure a loan of £720 to cover the cost. Under the original terms it was found that concessions to the firm in lighting supply would represent some £500 a year, but, as the result of negotiation, this was reduced to from £225 to £250 during the war and a smaller amount afterwards. Under the scheme the firm contributes towards the cost of a ring main, which will enable fresh business to be obtained.

Worthing.—The T.C. has decided to realise a portion of the reserve fund to meet an estimated deficit of £1,984 on the electricity undertaking at the end of the present financial year. This reserve fund at present stands at £4,500.

TRAMWAY and RAILWAY NOTES.

Accrington.—It is stated that the female conductors on the cars are much dissatisfied at their exclusion from the recent award granting a war bonus to male employés, and intend to take steps to bring their claims before the tramway authorities.

Ashton-under-Lyne.—TRAMWAY PURCHASE.—A public meeting of ratepayers, on Wednesday last week, authorised the Corporation to proceed with a Parliamentary Bill to obtain powers to purchase the Oldham, Ashton, and Hyde Tramway Co.'s undertaking within the borough and in the adjoining villages of Waterloo and Bardsley; power is also sought to construct connecting tramways, at a cost of about £5,000, and to run a motor-'bus service.

Australia.—The Premier of Western Australia recently called a conference of representatives of the Perth, Subiaco, and Victoria Park Municipal Councils and the Perth and Claremont Road Boards, to discuss a proposal to vest the management of the Perth Tramways in the Municipalities concerned. The Premier pointed out that the Government absolutely believed in the local authorities carrying out their responsibilities, and one of these was the tramway service. A Committee was appointed to inquire and report to a future conference.—*Tenders.*

Bradford.—ELECTRIC VEHICLE.—The Lingfield Dyeing Co., Ltd., has recently taken delivery through the local agents of a 2-ton G.V. electric delivery van, fitted with Ironclad Exide battery.

Cardiff.—YEAR'S WORKING.—The report of the year's working of the Corporation tramways to March 31st last shows that the total revenue was £167,794, working expenses amounted to £90,733, and the gross profits to £78,350. After payment of interest, £24,803, sinking fund, £23,988, income-tax, £3,708, and allowances to employés on war service, £5,326, there was a net balance of £20,525, as compared with £16,949 in the previous year. Of this £6,947 has been carried to the depreciation account, and the balance, £13,578, to reserve. The car-mileage was 2,399,240; the passengers carried numbered 30,878,116. The average revenue per car-mile was 14·343d.; the working expenses, including power, were 7·514d. The total amount of sinking fund and loans repaid was £310,606, and other funds in hand amount to £110,359.

Carlisle.—The City Council has approved the action of the Watch Committee in refusing another application of the Tramways Co. to licence women as drivers of the cars.

Continental.—SPAIN.—A concession has been awarded to the Sociedad Los Tranvias de Zaragoza for the construction and working of an electric tramway in Saragossa.—*Board of Trade Journal.*

Edinburgh.—TRAMWAYS PURCHASE SCHEME.—The proposal to adopt the overhead trolley system for the city tramways when they are taken over by the T.C. has led to opposition on the part of the Cockburn Association, one of the influential societies in the city, and it is intended to petition against this part of the proposal.

The T.C. has decided to purchase the cable cars from the Tramway Co. at the end of the lease for £50,000.

Glasgow.—A meeting of the Tramways Committee has been held with a view to considering the growing development of traffic, and efforts are to be made to secure a rearrangement of hours of factories, &c., and alteration of shopping times, with a view to relieving congestion.

Gosforth.—The U.D.C. has decided to draw the attention of the B. of T. to its complaint regarding the inconvenience of the front-entrance cars, and the irregular service given by the Newcastle tramways.

Halifax.—YEAR'S WORKING.—The annual report of the tramways department for the year ended March 31st last shows a net profit of £19,055, as compared with £16,211 in the previous year. Whilst the working expenses of the year were reduced by £1,258, the total revenue increased by £432. The passengers carried numbered 21,024,003, as against 20,707,071. There are 86 female conductors on the system.

In its reply to the L.G.B., stating schemes which it has in prospect for after the war, the Corporation includes as "urgent work" the relaying of tramway track at a cost of £31,556.

Hyde.—PROPOSED TRAMWAY PURCHASE.—The T.C. has decided to proceed with negotiations with the Oldham, Ashton and Hyde Tramway Co. for the purchase of the length of line within the borough. Negotiations are to be entered into with the Tramway Co. and the Stockport Corporation for the working of the tramway from August next until the purchase has been completed.

Leeds.—The effect of the railway restrictions has made itself manifest by the extraordinary increase of the number of people using the tramway cars since the restrictions came into force; the last week's receipts were up by £700. The number of passengers carried was 2,198,614, against 2,056,373 for the corresponding period of last year. At the present time there are nearly 80 cars withdrawn for repairs.

Manchester.—TRAFFIC CONFERENCE.—An informal conference has been held by the Manchester and Salford tramway departments. The increased traffic on the cars, due to the restricted railway service and the increase of fares, was one of the subjects under consideration, and special attention was devoted to the question of "rush" traffic in the mornings and evenings. The use of trailers and the employment of women as drivers were other matters touched upon, whilst there was also discussed the problem of fares and the question of increasing them or reducing the length of the stages. The conference is probably the prelude to joint action between the two authorities.

Oldham.—The manager (Mr. Priestley) of the Corporation tramways reports that the recent arbitration award, in which Oldham was included, will mean an increase of £3,500 per annum in wages in that department alone. The suggestion was made at the meeting of the Committee that the town might reap benefit from the curtailment of the train service by more through-cars being run to and from Manchester, but the manager said the Manchester Corporation was unable to help, owing to the shortage of labour. There were nine cars running through, but 13 would be required for a 10-minutes' service. The question of running non-stop cars was raised, but the manager pointed out that the B. of T. compulsory stops would have to be observed, and they had not the men to work such a system.

Rotherham.—SUGGESTED TRAMWAY PURCHASE.—The Corporation has decided to inquire upon what terms the undertaking of the Mexborough and Swinton Tramways Co. may be acquired by the municipality.

Salford.—The question of revising fares and other working arrangements in connection with the tramways is to be considered by the Tramways Committee in Salford and other south-east Lancashire towns.

Southend-on-Sea.—The Tramways Committee has inspected a car in which the lighting has been rearranged, and a similar improvement is to be made in the lighting of other cars. The electrical engineer has been in communication with the B. of T. upon a proposal to convert certain of the tramcars into double-decked cars. The Board suggests that the conversion should, in the first place, be carried out on large bogey cars, and inquiries are to be made of other towns where a similar gauge of light railways is in use as to their experience of the running of double-decked cars.

Stretford.—TRAMWAY STOPPAGE.—As a result of the breakdown of one of the engines at the electricity works, the tramway service of the Manchester Corporation in the district was temporarily interrupted; after a delay of about two hours a temporary supply was obtained from the Manchester electricity works. The cause of the breakdown was the extraordinary demand for power for factories.

Surbiton.—ELECTRIC DUST VANS.—A deputation of the D.C. has waited on the L.G.B. urging the necessity that permission should be granted for the purchase of two electric vehicles for the collection of house refuse. At a recent meeting of the Council it was decided that Edison Accumulators, Ltd., be informed that, in the event of the refusal of the Board for permission to purchase by instalments, the Council will purchase one vehicle for cash and hire another for 12 months, on the understanding that the Council will purchase the vehicle for the sum mentioned in the specification, less hire cost, at the expiration of that period.

Walsall.—CURIOUS ACCIDENT.—As the result of a tramcar losing its driver, a curious accident, or, to be more correct, a series of accidents, occurred between Walsall and Willenhall, on Friday in last week. The driver of the car, in looking round at his trolley, fell off, and as a large picture belonging to one of the passengers obscured the view of those inside, neither the conductress nor the passengers were aware of the mishap for a time. When the conductress discovered the absence of the driver she immediately applied the brakes, but as the car was then descending a slope, the brakes were not sufficient to stop its career. The consequence was that it dashed into a two-horse laundry van. Directly after this collision a youth got on to the platform, and, fortunately, succeeded in bringing it to a standstill. The driver of the van, and a child who accompanied him, escaped uninjured. Meanwhile the driver of the car, after falling off, ran after it for some distance, then tried to get on to a motor-lorry going in the same direction, but slipped, and one of the wheels passed over his legs, which was badly crushed. He was taken on the lorry to where the car had stopped before it was realised how serious his injuries were.

TELEGRAPH and TELEPHONE NOTES.

Grant to Bell Employes.—The American Bell Telephone System has decided to distribute more than $6,000,000 among its employés, to help to meet the increased cost of living.

U.S. Wireless Law.—A Bill has been introduced into the U.S. Congress to strengthen the Government control of radio-communication.—*T. and T. Age.*

Midway Island.—To convey their "cordial greetings and best wishes for the New Year," the Commercial Cable Co. have sent us a coloured card illustrating Midway Island as a barren waste in 1900, and as a cultured colony in the occupation of the Commercial Pacific Cable Co.'s cable staff. We gave some particulars recently of the transformation effected by the company (E.R., October 13th, 1916).

Railway Signal Breakdown.—The fusing of a cable connected with the electrical signalling apparatus at London Road (L. & N.W. Railway) Station, Manchester, last week, greatly interfered with traffic. The points being affected, trains were unable to complete the journey, some of them being held up for long periods, whilst many passengers from Longsight walked along the track as the quickest way of reaching town.

Wireless Record.—According to the *T. and T. Aye*, the steamer *Floridian*, San Francisco to Sydney, maintained communication with the Marconi station at San Francisco up to a distance of 3,000 miles, and her position reports were received up to a distance of 5,227 miles. The standard Marconi 2-KW. 500-cycle set was used on the ship.

Mr. David Sarnoff has been appointed manager of the commercial department of the Marconi Wireless Telegraph Co. of America.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—SYDNEY.—Feb. 19th. Municipal Council. Meters, maximum-demand indicators, feeder regulators. Specification from E.L. Department, Town Hall.

March 5th. Council. One 7,500-K.V.A. turbo-alternator. See "Official Notices" January 5th.

Bambridge.—February 3rd. Urban Council. Public lighting of the district with gas or electricity.

Bedford.—Electricity Department. Extensions, comprising buildings, boiler-house plant, turbo-generator, steam and water auxiliaries, switchgear, &c. See "Official Notices" to-day.

Halifax.—February 12th. Corporation Tramways Committee. Stores and materials, including lighting materials, wheel brake blocks, trolley and overhead line materials, &c., for twelve months. Tenders to Tramways Engineer.

London.—BATTERSEA.—February 6th. Electricity Department. Oils, engine-room stores, meters, joint boxes, &c. See "Official Notices" to-day.

Manchester.—February 2nd. Electricity Committee. Cooling towers. See "Official Notices" to-day.

Middlesbrough.—February 1st. Corporation. Twelve months' supply of electric lamps. Mr. S. E. Burgess, Borough Engineer.

New Malden.—January 31st. Malden and Coombe U.D.C. Installation of fire-alarm system. Particulars from the Council's Engineer.

New Zealand.—TAURANGA.—February 12th. Borough Council. Supply of six three-phase transformers, 11,000-400 volts. Messrs. H. W. Clime & Sons, Consulting Engineers, Raetihi.—*N.Z. Shipping and Commerce.*

Salford.—Tramways Committee. Steel tires, pinions, and gear wheels. General Manager, 32, Blackfriars Street.

South Africa.—DURBAN.—February 12th. Six four-ton electric travelling portable jib-cranes for the harbour.*

March 8th. Department of Post and Telegraphs. Installation of an automatic telephone exchange at Pietermaritzburg. See "Official Notices" to-day.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Department in London.

CLOSED.

Cape Town.—The tender of Messrs. E. A. Shaw & Co. for the wiring of the Victoria Court Flats, at £800, has been accepted. The work comprises about 245 lighting points and 34 bell points.

Sleaford.—U.D.C. Coal for the electricity works to June 30th: D. Pattinson & Co., 27s. per ton.

Southend-on-Sea.—Town Council. Contracts placed:—

John Brown & Co., Ltd.—Tires, £373.
P. R. Jackson & Co.—Armature coils, &c., £303.
S. Stone & Co.—Bar steel, iron, &c., £190.
Hider Dempster.—Springs, white metal, &c., £219.
British Thomson-Houston Co.—Field coils, £162; gear cases, &c., £68.

Messrs. Chamberlain & Hookham have given notice, under the provision of their contract for house-service meters, of intention to terminate the same, and have quoted amended terms for the continued supply of such meters. The electrical engineer is to report thereon.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Friday, January 19th. At 5.30 p.m. At Albemarle Street, Piccadilly. Lecture on "Soap Bubbles of Long Duration," by Prof. Sir James Dewar, F.R.S.

Institution of Mechanical Engineers.—Friday, January 19th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. General meeting.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, January 20th. At 4.30 p.m. At the Royal Technical College, Glasgow. Paper on "Modern Switch and Fuse Gear: Its Defects and some Suggested Remedies," by Mr. A. McPhail.

Association of Mining Electrical Engineers (Notts and Derbyshire Branch) and the National Association of Colliery Managers (Midland Branch).—Saturday, January 20th. At 3.30 p.m. At the University College, Nottingham. Paper on "Electrical Experience at Collieries," by Mr. C. Jones.

Salford Technical and Engineering Association.—Saturday, January 20th. At 7 p.m. At the Royal Technical Institute, Peel Park. Presidential address, by Mr. J. Morris, and musical social evening.

Institution of Civil Engineers.—Tuesday, January 23rd. At 5.30 p.m. At Great George Street, Westminster, S.W. Paper on "The Physical Features of 'Adam's Bridge' and the currents across it, considered as affecting the proposed construction of a railway connecting India with Ceylon," by Mr. F. J. Waring.

Liverpool Engineering Society.—Wednesday, January 24th. At the Royal Institution, Colquitt Street. Paper on "The Education of Apprentices to Engineering and Allied Trades," by Mr. T. R. Thomas.

Greenock Electrical Society.—Thursday, January 25th. At 7.45 p.m. At 22, West Stewart Street. Open night for discussion.

Physical Society of London.—Friday, January 26th. At 5 p.m. At the Imperial College of Science and Technology, South Kensington, S.W. General meeting.

NOTES.

F. L. Rawson.—We read in the *Times* that on Tuesday last the police raided 90, Regent Street, W., the premises at which Mr. Frederick Lawrence Rawson carried on the business of a "Divine Healer." The *Times* says:—"Since the outbreak of war he claimed that he could allay, by his magic, the sufferings of the wounded, the perils of the missing, and the pangs of the starving prisoners in Germany. During the last fortnight public attention has been focussed on Mr. Rawson's exploits by a series of articles in the *Daily Mail*. A large staff of clerks, shorthand typists, and practitioners were employed in the business, and thousands of letters were said to go out every week to all parts of the world. Before taking up the career of a "divine healer" Mr. Rawson was in business in the city. On Monday the police visited the Regent Street premises and removed to an internment camp a Hungarian who was in Mr. Rawson's employment. On Tuesday Chief-Inspector Fowler, of Scotland Yard, with other officers visited Mr. Rawson's rooms and seized letters, documents, and books relating to his business. They were conveyed to Scotland Yard."

"Safety First" Council.—The first meeting of the London "Safety First" Council was held on January 15th, the Council, as constituted, consisting of representatives of 34 local authorities of the metropolitan area, 9 associations representing road users, 6 railway companies, most of the tramway and omnibus undertakings, the three Trade Unions connected with transport workers, and a number of prominent lighting and carrying companies. The following officers were elected:—President, Lord Sydenham; vice-president, Sir George Gibb, chairman of the Road Board; chairman of Council, Mr. J. W. Joynson-Hicks, M.P.; vice-chairmen, Sir Edward Smith, L.C.C., and Mayor of Hampstead (Alderman O'Bryen); hon. treasurer, the Mayor of Westminster (Sir George Welby); hon. secretaries, Messrs. H. E. Blain, A. P. Johnson, and A. E. Cave. Four Committees were elected, namely, General Purposes, Street Dangers, Publicity, and Drivers' Educational. The Council then proceeded to consider a number of "safety first" suggestions which had been received. Discussion took place with regard to the lighting regulations, and a resolution was passed asking the Street Dangers Committee to consider the question as early as possible.—*Daily Telegraph.*

Prohibited Exports.—A supplement to the *Board of Trade Journal* of January 18th contains complete lists of articles which, according to the latest information received by the Board of Trade, are prohibited to be exported to various destinations from British India, Canada, New Zealand, South Africa, Newfoundland, Egypt, Malta, Cyprus, Mauritius, and Ceylon.

Bachelet Patents for Sale.—From an announcement appearing in our advertisement pages to-day, it will be observed that the liquidator of four Bachelet companies is offering the patents for sale.

Decimal Coinage and the Metric System.—The Manchester and District Decimal Association has issued a preliminary circular focusing attention upon the considerations which have induced it to advocate the reform of British coinage and the adoption of the metric system of weights and measures. It is held that much of the new plant which has been so generally installed for the manufacture of munitions of war, and thousands of our workpeople, may be thrown idle at the end of the war unless we *now* remove all obstacles that would otherwise hinder the enormous expansion of our export trade that will be imperatively required to ensure continuity of employment and the maintenance of our national economic stability, amongst the chief of which is our archaic collection of systems of coinage and measurement. The Lord Mayor of Manchester is the president of the Association, and in the list of vice-presidents and Council there are numerous representatives of manufacturing firms of world-wide reputation, including electrical firms such as Messrs. Mather & Platt, Ltd., Vickers, Ltd., W. T. Glover & Co., Ltd., the British Westinghouse Co., Ltd., Electromotors, Ltd., Ferranti, Ltd., and the Lancashire Dynamo and Motor Co., Ltd., as well as mechanical engineers, textile manufacturers, shipping merchants, &c.

Pointing out that the British Empire, Siam, and Persia are the only nations that have not adopted a decimal system of coinage, and that all our financial transactions are based on a rate per cent., which indicates the fundamental necessity of a decimal system in business, the circular advocates the adoption of the system of coinage which we have also recommended—viz., the decimal subdivision of the sovereign, without altering the existing values of our gold and silver coins. The florin would be the standard coin, divided into 100 cents instead of 96 farthings. The bronze coinage would be depreciated 4 per cent., but, as we have pointed out, at a time when standards of value have been so violently disturbed, a reduction of 4 per cent. in the purchasing value of the penny would be unfelt, and the present is obviously a most opportune moment for revising our coinage. The Association emphasises the fact, on the importance of which we have laid stress, that according to the foregoing proposal the pound sterling is retained. The adoption of the metric system of weights and measures is similarly regarded as certain to bring benefits far outweighing any temporary difficulties and inconveniences met with during the period of transition, and the Association expresses the intention of urging the Government to take action on these lines at an early date. An appeal is made for support, the subscription for members being one guinea per annum and for associate members 5s. Mr. Fred Hilton, of 55, Market Street, Manchester, is acting secretary.

Volunteer Notes.—FIRST LONDON ENGINEER VOLUNTEERS.—Headquarters, Balderton, Oxford Street, W.—Orders for the week, by Lieut.-Col. C. B. Clay, V.D., Commanding :—

Monday, January 22nd.—Technical for Platoon No. 9, at Regency Street. Squad and Platoon Drill, Platoon No. 10. Signalling Class. Recruits' Drill, 6.25—8.

Tuesday, January 23rd.—School of Arms, 6—7. Lecture, 7.15, "Musketry," by the Instructor of Musketry.

Wednesday, January 24th.—Instructional Class, 6.15. Platoon Drill, Platoon No. 2.

Thursday, January 25th.—Platoon Drill, Platoon No. 7. Ambulance Class by M.O., 6.30.

Friday, January 26th.—Technical for Platoon No. 10, Regency Street. Squad and Platoon Drill, No. 9. Signalling Class. Recruits' Drill, 6.25—8.25.

Saturday, January 27th.—N.C.O.'s Class, 2.30, by Company Commander E. C. Fleming.

Sunday, January 28th.—Entrenching at Otford. Parade Victoria (S.E. & C. Railway Booking Office), 8.45 a.m.

(By order), MACLEOD YEARSLEY, *Adjutant.*

Institution and Lecture Notes.—The Faraday Society.—At the annual general meeting of the Society, on December 18th, the following officers and Council were elected :—

President.—Sir Robert Hadfield, F.R.S.

Vice-Presidents.—Prof. K. Birkeland, W. R. Bousfield, K.C., F.R.S., Prof. F. G. Donnan, F.R.S., Dr. Eugene Haanel, Prof. A. K. Huntington, Dr. T. Martin Lowry, F.R.S.

Treasurer.—F. Mollwo Perkin, Ph.D.

Council.—W. R. Cooper, Dr. C. H. Desch, Dr. J. A. Harker, F.R.S., Emil Hatschek, Cosmo Johns, Prof. Alfred W. Porter, F.R.S., E. H. Rayner, A. Gordon Salamon, Dr. George Senter, Cav. Magg. E. Stassano.

Birmingham and District Electric Club.—At the annual meeting the following officers were elected :—President, Mr. A. B. Mudie ; vice-presidents, Mr. H. Foulds and Mr. J. J. Richardson ; hon. secretary, Mr. N. Deykin ; hon. treasurer, Mr. W. H. Varnon. The report referred to the services rendered by Mr. W. G. L. Riddle, who had filled the office of president for two years and of hon. secretary for nine years. The financial statement showed a considerable balance in hand, and it was decided to invest part of the surplus funds in war certificates.—*Birmingham Daily Post.*

Bread and Butter Machine.—An electric machine of British manufacture, capable of cutting 3,000 slices of bread an hour, and buttering them, has just been produced and supplied to a number of shipbuilding works on the Clyde.—*Financial Times.*

Appointments Vacant.—Shift engineer (42s.), for the Queen Mary's Military Hospital, Whalley ; temporary assistant electrical engineer, for the Barking U.D.C. electricity works ; mains engineer, fitter drivers and engine drivers, wiremen, stokers and fitters for the War Department (hutted camps, electric power houses). See our advertisement pages to-day.

Fire.—The battery room and its equipment at the station of the Merthyr Electric Light and Traction Co., Ltd., was destroyed by fire on January 9th. The cause of the outbreak is unknown.

Electric Signalling on the G.W. Railway.—The installation of track signals, combined with electrically-worked distant signals at "slipping" stations, has been a feature of interest in connection with the work of the Signal Department of the Great Western Railway during the past year. Installations of this kind have been brought into use at Slough, Exeter, Taplow, and Wantage Road, while others are in progress at Reading, Newbury, Kingham, and other places.

Workmen's Compensation.—At Blackburn County Court, his Honour Judge Sturges sanctioned a settlement of £300, in addition to £10 already paid, in a case in which Ellen Hunter claimed compensation from Messrs. Yates & Thom, Ltd., Canal Foundry, for the loss of her husband, who, in November, 1916, was following his occupation as an electric crane driver, when he was caught between the crane and a pillar, and crushed to death. Mr. Harry Backhouse appeared for the widow, and Mr. John Taylor for the employers.

Trench Foot and Electric Leakage.—In the *Lancet* of January 13th, Dr. C. N. Longridge discusses the cause and prevention of trench foot in the light of a theory of electro-pathology which he attributes to Mr. A. E. Baines, "a distinguished electrical engineer." The theory in question is that the brain, and possibly the spinal cord, is the seat of electrical generation, and that the current so generated is carried to the tissues by means of the nerves ; Dr. Longridge predicts that Mr. Baines will ultimately rank with Simpson, Lister, and Koch as a benefactor of the human race, but however that may be, the extent of his own electrical knowledge may be gathered from the following explanation of the origin of trench foot :—

"The dominating factor in the conditions under which trench foot occurs is wet. When a man is standing for days on end in water and liquid mud, his boots, socks, and the skin of his feet and legs become soaked. As is well known, the electrical resistance of the skin is enormously diminished when the skin is wet. Under these conditions a gradual leakage of electricity to earth takes place from the feet. Other things being equal, electricity will always leak from a point in preference to a plane surface, which accounts for the fact that the toes are most affected. This leakage deprives the cells of the foot tissues of their trophic influence, and they die. Hence the lesions of trench foot."

Dr. Longridge has carried out experiments with a view to testing his theory, and remarks that "before testing it is necessary to 'earth' the patient in order to dissipate any induced charge of electricity of which he may be the host. If this is not done, the patient's own intrinsic current may be swamped by charges he has picked up from trams, electric trains, or other sources. With both poles in contact with the body the galvanometer will give a deflection. When leakage is taking place from any particular area a high and rapid deflection is noted."

It will be observed that he makes no distinction between static charges and electric currents ; nor does he, apparently, allow for the fact that any circuit through the earth is liable to carry currents of voltaic or thermoelectric origin, or stray currents from other sources, or that a delicate galvanometer will register currents if the moistened figures are placed on the terminals—not "body currents" at all, but ordinary commonplace currents that would equally well be produced by a slice of beefsteak. Hence the experiments which he describes are wholly illusory. Naturally, as the result of misleading experiments and fanciful hypothesis, he comes to the appropriate conclusion that treatment of the feet with *dielectric oil* gives better results than any other method.

"The experience of officers at the front is that trench foot can be prevented. I am certain it can, but it can only be done, firstly, by keeping out the wet, and, secondly, by keeping up the electrical resistance of the skin of the feet. The feet should be thoroughly greased, and by far the best grease to use is the dielectric ointment which is now an article of commerce."

Certainly, keeping out the wet and anointing the feet are sure to be salutary and beneficial measures—but the electrical theory is all nonsense.

Tudor Accumulator Co., Ltd.—The Public Trustee is inviting tenders for the purchase of 3,579 "A" shares and 1,200 "B" shares, all of £10 each, in the above company. Particulars appear in our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The chief clerk in the Ealing electricity department is to be given a war bonus of £10 per annum. A similar war bonus is to be paid to the assistant engineer and the mains superintendent. Salaries of the clerical staff are to be increased by from 2s. 6d. to 3s. 6d. weekly.

The Sunderland T.C. has approved of the following changes of salary : Chief assistant electrical engineer and sales manager, £300 to £325 ; superintendent, Hylton Road electricity

works, £275 to £300; chief clerk, £250 to £260; testing superintendent, £200 to £215; wages—cable jointers increased by 1s. 0½d. per week; junior cable jointers by 2s. 1d.; meter testers 2s.; installation and meter inspectors by 2s. The tramway traffic superintendent's wage was increased from £3 5s. to £3 10s. per week.

Major H. GREY, the electrical engineer to the Accrington Corporation, who is on active service, has tendered his resignation. The General Purposes Committee, however, have made arrangements by which he will continue in office until the end of the war.

Upon the recommendation of the electrical engineer at Barnes, Mr. LAW and Mr. CORNET are to be granted, as recognition of their valuable services during the past year, honoraria of £30 and £20 respectively.

The Finance Committee of the Whitehaven T.C. has recommended that the salary of the acting electrical engineer, Mr. GILLITT, be increased to £250 a year, on the understanding that he is not paid any premiums in respect of pupils.

Colchester T.C. has appointed Mr. SHEPPARD, of the electricity works staff, to succeed Mr. Cottam as shift engineer.

Sapper A. GREED, R.E., Wireless Section, who has been discharged from the Army after an attack of malaria, has resumed his duties in the mains department of the Dewsbury Corporation electricity works.

The Leatherhead & District Electricity Co., Ltd., have granted their manager, Mr. H. LESLIE DIXON, leave of absence to accept a commission in the Royal Flying Corps.

The Newcastle-under-Lyme Corporation has increased the salary of Mr. A. J. C. DE RENZI, borough electrical engineer, to £250 per annum.

On the occasion of his marriage, Mr. J. H. WILLIAMS, of the Urban Electric Supply Co., Ltd., Grantham, was presented with a cruet by the members of the staff at Grantham. Mr. Edmundson, the manager, made the presentation.

General.—Mr. F. A. B. LORD, member of the London Chamber of Commerce, and of Messrs. W. F. Dennis & Co., has been nominated to the vacancy on the ward of Cordwainer for the City Corporation by the Common Councilmen of the ward.

Roll of Honour.—Flight Sub-Lieutenant NEVILLE W. FRAMES, of the staff of the Port Elizabeth Municipal electricity department, South Africa, was killed on active service in November last.

Corporal A. V. SCHOLES, of the Royal Flying Corps, who was formerly telegraphist at the Huddersfield Post Office, has been awarded the Military Medal for efficiency and gallantry in maintaining communication with an aeroplane by wireless telegraphy while under heavy fire.

The following is a list of employés in the Oldham Corporation tramways department who have laid down their lives during the war:—Private J. W. Hopson, aged 25; Private T. H. Hilton, aged 24; Private Foster Irving, aged 26; Private Harry Slinger, aged 32; Private J. L. Taylor, aged 26; Sergeant J. Wright Wood, aged 40; Sergeant H. Shaw; Sergeant-Major A. Dale; Private E. Custy; Private J. Cartledge; Corporal J. W. Rose; Private T. Winstanley, aged 35; Private S. Crawshaw, aged 20; Private J. Wilson, aged 24; Private S. Hallam, aged 21 (awarded Military Medal some time before his death).

Corporal R. E. BRITTON, No. 7,000, No. 1 Siege Company, Royal Monmouth. R.E., who has been mentioned in Sir Douglas Haig's dispatch of November 13th, was an apprentice in the office of the electrical engineer to the Swansea Harbour Trust.

Sergeant JAMES SMITH, of the Scottish Rifles, and formerly employed on the Blackburn Corporation Tramways, has been awarded the Military Medal.

Quartermaster and Hon. Lieutenant TUTT, Welsh Regiment, and Sergeant (Acting Company Sergeant-Major) D. A. HOPKINS, Welsh Regiment, mentioned in dispatches, were employed in the Swansea Corporation electricity department.

Private E. STEWART, Seaforth Highlanders, an electrician, has died from wounds.

Private O. H. DAVIES, Canadian R.A.M.C., who was an electrician on the Canadian Pacific Railway, has been awarded the Military Medal for gallant conduct in his attention to wounded under heavy shell fire.

Corporal EDWARDS, V.C., has been presented with a gold watch and chain, subscribed for by his fellow-workers at the Western Electric Co., Ltd., Woolwich.

Sergeant ARTHUR WANDBY, Rifle Brigade, has been awarded the D.C.M. He was employed by the Leeds Private Telephone Co.

Sergeant JAMES SMITH, of the Cameronians, formerly employed on Blackburn Corporation tramways, has been awarded the Military Medal.

LESLIE HULME, who is in the Flying Corps in France, and was previously employed by Messrs. Dick, Kerr & Co., Preston, has been promoted to first-class air mechanic in the wireless section.

Sapper JOHN WHARTON, R.E., has been awarded the D.C.M. for gallantry on the field. He was an articled apprentice to Mr. J. Morris, electrician, Bolton.

Acting-Corporal HAROLD SHARP, A.S.C., who has been mentioned in dispatches, was an employé in the Leeds Corporation electric lighting department.

Boy Telegraphist ERNEST KELLY, R.N., who has won the D.S.M., after being previously recommended for it on three occasions, is only 17 years of age. He was with the British Westinghouse Co., at Manchester, until two years ago, when he entered the Navy. He is on a Dover patrol mine sweeper.

A. B. WOODHOUSE, of the R.N.D., only son of Mr. William Woodhouse, who is associated with the Yorkshire Electric Power Co., has been killed in action.

Private C. E. PALMER, Royal Fusiliers, Lewis Machine Gun Section, for 11 years on the staff of the L.C.C. tramway depôt at New Cross, has died of wounds received in action.

Private LEONARD BLANKS, Royal West Kent Regiment, who enlisted whilst with Messrs. S. W. Gibson & Co., electrical engineers, of Dartford, has died whilst a prisoner of war in Turkey.

Private A. SKIRROW, of the West Riding Regiment, is in hospital wounded. He was employed in the Leeds Corporation electric lighting department.

Many of our readers will desire to join us in congratulations to Sergeant J. CONWAY PRICE, of the Welsh Guards, upon having been mentioned in Sir Douglas Haig's dispatch of November 13th, 1916, for distinguished and gallant service and devotion to duty.

Obituary.—CAPTAIN W. T. LE FEUVRE.—The death has taken place in hospital, at Bangor, of Captain Walter T. Le Feuvre, R.E., the borough electrical engineer of Bexhill. Prior to the war the deceased had held a commission in the Territorial Army, and in 1914, having obtained leave from the Corporation, he took a commission in the Royal Engineers. He served in France for some months, but owing to an injury to the ankle he was returned for home service, and was acting as instructor when he was taken ill with pneumonia, which caused his death. Captain Le Feuvre held the post of electrical engineer to the Bexhill Corporation from the establishment of the undertaking 16 years ago. He was in his 43rd year, and leaves a widow and two daughters. During his absence on war service Mr. C. A. Frost, assistant engineer, has been in charge of the works.

NEW COMPANIES REGISTERED.

Pressparts, Ltd. (145,747).—Private company. This company was registered on January 11th, with a capital of £3,000 in £1 shares, to take over the business of an electrical and mechanical appliance manufacturer, sheet metal worker, stamper, piercer, solderer, welder, polisher, and plater carried on by Henry Justus Eck at Darwin Works, Salop Street, Birmingham, as Pressparts. The subscribers (each with one share) are: Edwin B. Alldridge, 354, Gillot Road, Edgbaston, Birmingham, coppersmith; Henry Justus Eck, 10, Priory Road, Chiswick, W., engineer; Alfred C. Lee, 107, Wake Green Road, Moseley, Birmingham, coppersmith. The first directors (to number not less than three or more than five) are: Edwin B. Alldridge, Henry Justus Eck, and Alfred C. Lee. Mr. E. H. Clutterbuck, solicitor, has filed the usual declaration that the company is not formed for the purpose or with the intention of acquiring all or any part of any business the books and documents of which are liable to inspection under the Trading with the Enemy Act, 1914. Solicitors: Lane, Clutterbuck & Co., Minories Chambers, Birmingham. Registered office: 8, Salop Street, Birmingham.

Ridout & Ratcliff, Ltd. (145,740).—Private company. This company was registered on January 10th, with a capital of £2,000 in £1 shares, to take over the business of an electrical contractor formerly carried on by G. F. Ratcliff, at 43, Baker Street, but now at 42, Upper Baker Street, W., and the business of an electrical engineer carried on by L. Ridout, at the last-named address. The subscribers (each with one share) are: L. Ridout, 42, Upper Baker Street, W., electrical contractor; G. F. Ratcliff, 42, Upper Baker Street, W., electrical contractor. The first directors are to be appointed by the subscribers. Solicitors: Turner & Co., 89, Chancery Lane, W.C. Registered office: 42, Upper Baker Street, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

James Keith & Blackman Co., Ltd.—A memorandum of satisfaction in full on December 11th, 1916, of second debenture dated February 12th, 1913, securing £1,000, has been filed.

Northampton Electric Light & Power Co., Ltd.—Issue on January 2nd, 1917, of £1,835 debentures, part of a series of which particulars have already been filed.

Musselburgh and District Electric Light & Traction Co., Ltd.—A memorandum of satisfaction to the extent of £800 on December 27th, 1916, of charges dated November 13th, 1905, and May 11th, 1909, securing £90,000, has been filed.

Southern Brazil Electric Co., Ltd.—Loan contract with mortgage and pledge executed by way of local mortgage, executed abroad on October 17th, 1916, as collateral security for £750,000 debentures covered by trust deed of August 19th, 1914. Property charged: Certain concessions, lands, water rights, and immovable property in Brazil, and shares in other companies. Holders: Royal Exchange Assurance Co.

Delagoa Bay Development Corpn., Ltd. (76,099).—Capital, £166,300 in £10 shares. Return dated December 5th, 1916 (filed December 6th). 267,400 shares taken up; 10s. per share called up on 177,400; £88,700 paid; £45,000 considered as paid on 90,000 shares. Mortgages and charges: £188,900.

East India Tramways Co., Ltd. (74,457).—Capital, £100,000 in £1 shares (15,000 pref., 35,000 ord., and 50,000 def.). Return dated December 15th, 1916. 7,476 pref., 33,433 ord., and 50,000 def. shares taken up; £1 per share called up on 7,476 pref. and seven ord. shares; £7,489 paid, including £6 paid on 24 pref. shares forfeited; £83,426 considered as paid on 33,426 ord. and 50,000 def. Mortgages and charges: Nil.

Harold Wood Electrical & Engineering Supplies Co., Ltd. (93,423).—Capital, £1,000 in 950 pref. ord. shares of £1 each and 1,000 def. shares of 1s. each. Return dated December 8th, 1916. All shares taken up; £1,000 paid. Mortgages and charges: £600.

Hampshire Light Railways (Electric), Co., Ltd. (52,564).—Capital, £1,000 in £10 shares. Return dated December 7th, 1916. All shares taken up; £1,000 paid. Mortgages and charges: Nil.

Blackpool & Garstang Electric Light Railway Co., Ltd. (62,150).—Capital, £10,000 in £5 shares. Return dated December 29th, 1916. 361 shares taken up; £4 per share called up; £1,707 paid (including £323 received on application for further shares not allotted), leaving £60 in arrears. Mortgages and charges: Nil.

Railway Finance & Construction Co., Ltd. (formerly known as Electrical Equipment & Securities, Ltd. Re-named 1909.) (72,015).—Capital, £100,000 in £1 shares. Return dated November 13th, 1916. 92,292 shares taken up; £1 per share called up on 657 and 4s. per share on 29,595; £6,576 paid; £85,716 considered as paid, being 16s. per share on 29,595 and £1 per share on 62,040. Mortgages and charges: Nil.

CITY NOTES.

Tata Hydro-Electric Power Supply Co., Ltd.

The annual meeting of this company was held in November, at Bombay, Sir DORAB J. TATA presiding. The president, referring to the present position of the company and its future prospects, said that the supply of power was generally satisfactory to their consumers. The equipment of all mills intended to be served with power from the first installation of generating plant was now nearly complete, and they were being regularly supplied. They were pushing forward as much as possible the equipment of those mills which were to receive power from the second installation, but some unavoidable delay was being experienced owing to certain restrictions now placed upon the manufacturers of the driving equipment by the British Munitions Department. On the completion of the equipment, the average consumption of electrical energy in Bombay supplied by the company would approximately be 40,000 electrical H.P. The fifth generating unit, with complete equipment, would soon be in service. The hydraulic works comprised in the first construction contract were practically completed. The work of building the Shirawta dam, which would take some time to complete, was in full progress. On its completion, their capacity to supply, so far as hydraulic development was concerned, would be considerably augmented, enabling the scheme to be gradually extended to its safe limit of output. The payment of interest out of capital had ceased from January 1st, 1916, from which date dividends and debenture interest would be paid from revenue. The concessions which this company had in the Andhra Valley had been transferred to a new company, which was established under the name of the Andhra Valley Power Supply Co., Ltd. An agreement was to be drawn up between the two companies in order to facilitate the co-operation of the two companies in fullest harmony.—The report and dividend recommendation given in the ELECTRICAL REVIEW for January 5th, 1917, were approved. The meeting subsequently confirmed the resolution passed at an earlier meeting increasing the capital to Rs. three crores by the creation of 10,000 new shares of Rs. 1,000 each.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—The report for 1916 states that, after providing for all expenses, there is a net income of £26,188. A dividend of 6 per cent. per annum, less income-tax, on the 6 per cent. cumulative preference shares has been paid, £12,525 taken to depreciation, renewals and reserve, and £17,952 carried forward. The number of passengers carried during the year was 12,888,274, and the miles run 1,768,007, as against 11,602,483 and 1,763,702 respectively for the previous year.

Imperial Tramways Co., Ltd.—Mr. Samuel White, J.P., has been elected chairman of the company in the place of the late Sir George White, Bart.; Sir G. Stanley White, Bart., has been elected a director; Mr. W. G. Verdon Smith, the secretary of the company for the past 15 years, has been appointed managing director, and Mr. F. H. Withers secretary.

Edmundson's Electricity Corporation, Ltd.—The directors have decided to withhold payment of the six months' dividend on the cumulative preference shares payable January 15th until the accounts for the financial year ending March 31st are prepared.—*Financial Times.*

Bristol Tramways & Carriage Co., Ltd.—Mr. Samuel White, J.P., has been elected chairman of this company in the place of the late Sir George White, Bart., and Mr. S. E. Baker has been elected a director.

Nairobi Electric Power & Lighting Co., Ltd.—Interim dividend at the rate of 6 per cent. per annum on the preference and ordinary shares for the December half-year.

Rio de Janeiro Tramway, Light & Power Co., Ltd.—Dividend, 1¼ per cent. on the issued capital.

Sao Paulo Tram, Light & Power Co., Ltd.—Dividend, 2½ per cent. on the issued common stock.

Bank Rate.—Yesterday the Bank rate was reduced from 6 per cent. to 5½ per cent.

STOCKS AND SHARES.

TUESDAY EVENING.

THE present are War Loan markets. Everybody is trying to do his and her utmost to make the loan a success, and little else is talked about in the Stock Exchange to-day. With the loan itself there is general satisfaction. Hardly any points have cropped up which call for effective criticism; and an excellent feature is the fact that February 16th is definitely announced as the date for closing the subscription lists. One great point in favour of the loan is that it establishes a lower rate of interest than that which the Government was offering before it appeared.

In each of the preceding War Loans a higher rate was offered every time, with the result that people said they would take half the amount which they felt able to subscribe, and then wait for the next Government issue, to see whether better terms would not be given. Now, however, instead of the 6 per cent. provided by the recent Exchequer Bonds and the 6½ per cent. obtainable from Treasury Bills, the Government has stepped forward with its 5 per cent. at 95; while Mr. Bonar Law held out a very plain hint that if this did not produce sufficient money, other and less favourable terms were what the investor might expect.

As was inevitable, a good deal of nonsense has been written about the War Loan by those who ought to know better; and a little more restraint on the part of the halfpenny Press would stimulate, instead of prejudice, the newcomer. Far-fetched schemes of raising money with which to apply for the loan are being advocated by the noisy sensation-mongers, who ignore, either deliberately or without knowledge, the results that would accrue from the following out of their counsels. There is doubtful national advantage to be gained from the wholesale realisation of securities which make an appeal only to British purchasers. If stocks can be sold to foreign buyers, so much the better; but there is small sense in robbing Peter to pay Paul; and if any sales of stock were to be attempted on a large scale, they would damage credit generally, and contribute indirectly to a weakening of the new War Loan.

At the same time, we have no sympathy whatever with those extremely astute people who work out calculations into decimal points, with a view to seeing how they can obtain an interest in the new War Loan through the purchase of existing stocks which carry conversion rights. Possibly they may be able to save a few shillings, but whatever they gain is of advantage only to themselves, and probably deprives the country of the new money which would be afforded it by direct subscription to the present issue.

Holders of the securities with which we deal week by week will find no national benefit served by their endeavouring to sell the stock and shares in the British companies comprised in our lists. If a holder of Brazilian Tractions elects to pass on his shares to a Dutch buyer, or if Mexico Tramway bonds can be sold to American purchasers, and the money realised from these sales be utilised in the purchase of the new loan, so much the better for this country and the victorious conclusion of the war. But to turn out good-class stocks simply with the idea of getting them transferred into other British hands is of very hypothetical value; while as for some of the means suggested for the raising of money in other directions, the majority are as ill-conceived as they are likely to prove useless in the attainment of the main object.

That the markets for purely investment stocks should be dull and quiet is natural enough. Brokers and jobbers know perfectly well that most clients are bent upon subscribing their spare cash to the new loan. At the same time, the declines which have taken place during the past week are comparatively trifling in amount—comparatively, that is to say, if one remembers the effects produced by the issue of the 4½ per cent. War Loan in 1915, when values fell steeply, and when, for a time, hundreds of securities became practically unsaleable.

The Home Railway market feels a good deal the influence of the latest competitor. In this department there has been a fair amount of selling—or, rather, of attempting to sell, because the jobbers are not keen to take stock unless they know where to place it. Many of the lower-priced descriptions which were in speculative favour some six weeks ago have given way somewhat sharply, and the Undergrounds fall with the rest. Underground Electric incomes broke away to 90½, a fall of 3¼ points, certain of the recent buyers, who had picked up the stock lower down, electing to take their profits. A partial recovery has left the stock at 91, and the company's shares are both easier. Districts declined to 16¼, and Metropolitans are 1½ lower, although in all these cases it has to be remembered that there have been recently sharp rises.

Electricity supply shares are exceedingly quiet, the reason being, of course, the uncertainty felt in connection with the approaching dividends, coupled with the advent of the new loan. Prices on the whole are well held, and proprietors are making no effort to sell. No doubt their tenacity is fortified by the decision of the Board of Referees in regard to excess profits duty, reference to which was made here last week.

The telegraph market is quiet. Anglo-Americans have gone back a little. In this market, as in most of the others, a good deal of attention is bent on the problem as to what industrials ought to pay the investor, in the light of the 5½

per cent. yield offered by a Government long-dated loan. The New York Stock Exchange has calmed down so considerably that from a daily turnover which reached over three million shares, dealings have dwindled to the neighbourhood of less than 200,000 in a day. The Globe Telegraph issues are both a little lower, Indo-Europeans fell 10s., and Marconis are quoted ex the dividend of 2s., allowing for which there is a trifling rise in the price.

News from Mexico is said to be worse this week, and most of the Mexican securities have gone back. Mexico Tramway Fives have fallen 5 points to 25. Nor are Brazilian things so good as they were last week. Brazil Tractions lost 1½ points. The various water and power companies connected with the Pearson group are inclined to be lower. Those undertakings concerned with munition-making in the United States and Canada are mostly dull. Dramatic breaks occurred in the shares of the Canadian Car & Foundry Co., the common losing 30 points in a day on account of an explosion which took place at the works.

Industrials followed the general trend of markets. British Westinghouse have weakened to 54s. 6d. Callenders ordinary and preference have both eased off; the preference, it may be worth pointing out, now return 6¼ per cent. on the money. Electric Constructions receded to 18s. 9d. British Insulated preference are lower at 5. The same tendency is noticeable amongst iron and steel shares. The rubber share market, however, keeps firm. There is not much business doing, naturally, on account of the attention absorbed by the War Loan; but the disposition is to look for higher prices amongst speculative shares generally as soon as the War Loan has settled down into permanent hands. Copper, the metal, shows no signs of improvement; and, consequently, most of the shares connected with the industry have lost small fractions on the week.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1914.	Dividend 1915.	Price Jan. 16, 1917.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	10	10	6⅝	—	£7 11 0
Charing Cross Ordinary ..	5	5	3⅜	—	7 8 2
do. do. do. 4½ Pref..	4½	4½	3½	— 1/16	6 18 6
Chelsea	5	4	3	—	6 13 4
City of London	9	8	11½	—	7 2 8
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	10½	—	6 18 8
do. 6 per cent. Pref.	6	6	9⅝	—	6 1 6
Kensington Ordinary	9	7	5⅜	—	6 4 5
London Electric	4	3	1⅜	—	6 10 5
do. do. 6 per cent. Pref.	6	6	4 1/16	—	6 15 4
Metropolitan	3½	3	2¼	—	6 13 4
do. 4½ per cent. Pref.	4½	4½	3⅜	—	7 4 0
St. James' and Pall Mall ..	10	8	6	—	6 13 4
South London	5	5	2⅝	—	6 19 0
South Metropolitan Pref. ..	7	7	1 3/16	—	6 7 8
Westminster Ordinary	9	7	5⅜	—	6 4 5
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	93xd	— ¾	6 9 0
do. Def.	30/-	33/6	22½xd	—	6 18 4
Chile Telephone	8	8	7xd	—	5 14 3
Cuba Sub. Ord.	5	5	8½	—	6 8 6
Eastern Extension	7	8	18¾xd	—	*5 15 4
Eastern Tel. Ord.	7	8	188xd	—1	*5 16 0
Globe Tel. and T. Ord.	6	7	12½	— ¼	*5 14 3
do. Pref. ..	6	6	9¼	— ⅛	6 1 6
Great Northern Tel.	22	22	37	—	5 19 0
Indo-European	13	13	49	— ½	5 12 8
Marconi	10	10	2 1/32xd	+ 3/32	3 14 9
New York Tel. 4½	4½	4½	101	—	4 9 0
Oriental Telephone Ord. ..	10	10	2⅛	—	4 9 0
United R. Plate Tel.	8	8	6 1/16	—	*5 19 8
West India and Pan.	1	6d.	1	—	2 4 0
Western Telegraph	7	8	13⅞	—	*5 15 4
HOME RAILS.					
Central London, Ord. Assented	4	4	65½	—	6 2 2
Metropolitan	1½	1	23½	—1½	4 5 1
do. District	Nil	Nil	16½	— ½	Nil
Underground Electric Ordinary	Nil	Nil	9	— ¼	Nil
do. do. "A" ..	Nil	Nil	6/6	—3d.	Nil
do. do. Income	6	6	91	—2½	*6 11 10
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4 1/16	—	6 1 6
Anglo-Arg. Trams, First Pref.	5½	5½	8	—	9 4
do. 2nd Pref. ..	5½	5½	2⅞	—	—
do. 5 Deb. ..	5	5	64½	—	7 15 0
Brazil Tractions	4	4	49	—1½	8 8 4
Bombay Electric Pref.	6	6	10½	—	5 17 3
British Columbia Elec. Rly. Pfce.	5	5	62xd	—	8 1 4
do. do. Preferred	—	Nil	4⅛	+1½	Nil
do. do. Deferred	—	Nil	33⅛	—2	Nil
do. do. Deb.	4½	4½	64	+1½	6 12 10
Mexico Trams 5 per cent. Bonds	—	Nil	25	—5	Nil
do. 6 per cent. Bonds	—	Nil	29½	—	Nil
Mexican Light Common ..	Nil	Nil	7⅝	—	Nil
do. Pref.	Nil	Nil	16⅞	—	Nil
do. 1st Bonds ..	Nil	Nil	27½	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	14	15	21⅜	—	5 6 9
British Aluminium Ord. ..	6	7	28/6	—	5 12 8
British Insulated Ord.	15	17½	11⅜	—	7 5 10
British Westinghouse Pref. ..	7½	7½	2 3/32	— 3/32	6 11 4
Callenders	15	20	12¼	— ⅛	7 15 4
do. 5 Pref.	5	5	4	— ½	6 5 0
Castner-Kellner	20	22	8 5/16	—	6 12 7
Edison & Swan, £3 paid ..	Nil	—	1/16	—	Nil
do. do. fully paid ..	Nil	—	1/16	—	Nil
do. do. 4 per cent. Deb.	4	4	61½	—	6 10 1
Electric Construction	6	7½	1⅜	— 1/16	8 0 0
Gen. Elec. Pref.	6	6	9½	—	6 3 1
do. Ord.	10	10	13½	—	7 5 6
Henley	20	25	16	—	7 13 10
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	12½	—	*8 0 0
Telegraph Con.	20	20	38	—	*6 5 0

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, January 17th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Muriate (large crystal)	,,	£64	..
a Bisulphide of Carbon	,,	£23	..
a Borax	,,	£34	..
a Copper Sulphate	,,	£65	..
a Potash, Chlorate	per lb.	2/6	..
a ,, Perchlorate	,,	2/-	..
a Shellac	per cwt.	142/-	..
a Sulphate of Magnesia	per ton	£16	..
a Sulphur, Sublimed Flowers ..	,,	£19	..
a ,, Lump	,,	£16	..
a Soda, Chlorate	per lb.	1/-	..
a ,, Crystals	per ton	120/-	..
a Sodium Bichromate, casks ..	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c ,, Tubes (solid drawn) ..	,,	..	..
c ,, Wire, basis	,,	..	..
c Copper Tubes (solid drawn) ..	,,	1/8 to 1/8½	½d. dec.
g ,, Bars (best selected) ..	per ton	£166	£9 dec.
g ,, Sheet	,,	£168	£9 dec.
g ,, Rod	,,	£166	£9 dec.
d ,, (Electrolytic) Bars ..	,,	£141	..
d ,, ,, Sheets ..	,,	£161	..
d ,, ,, Rods ..	,,	£149	..
d ,, ,, H.C. Wire	per lb.	1/5½	..
f Ebonite Rod	,,	3/-	..
f ,, Sheet	,,	2/6	..
n German Silver Wire	,,	2/3	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	8/8	..
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£38	£2 inc.
g Lead, English Pig	,,	£32 5	..
g Mercury	per bot.	£18 15	..
e Mica (in original cases) small ..	per lb.	6d. to 3/-	..
e ,, ,, ,, medium	,,	3/6 to 6/-	..
e ,, ,, ,, large ..	,,	7/3 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/10½	½d. dec.
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	,,	..	..
n ,, Wire, Nos. 1 to 16	per lb.	2/11	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons
r W. F. Dennis & Co.

Official Price of Aluminium.—The selling price of aluminium ingots of ordinary commercial purity of 98/99 per cent. has been fixed by the Ministry of Munitions at £225 per ton, carriage paid to consumers' works. The maximum selling price of re-melted aluminium scrap and swarf ingots of 98/99 per cent. purity has been fixed at £210 per ton, carriage paid to consumers' works. The maximum price must not be exceeded, but a lower one may be fixed by agreement between the seller and the buyer, based upon the Metallic Aluminium content. These prices are to take effect as from January 1st, 1917, and permits, under Regulation 30 A of the Defence of the Realm Regulations, will be granted only for such dealings in the above-mentioned materials as are in accordance with the above prices. The above prices are subject to alteration, at any time, as may be directed by the Minister of Munitions.

Patents and Alien Enemies.—Messrs. Vickers, Ltd., have withdrawn their applications in respect of Patents Nos. 19,282/05 and 26,322/07. A licence has been granted to Messrs. E. R. & F. Turner, Ltd., in respect of Patent No. 27,548/12, granted to Amme Giesecke & Konegen Akt.-Ges. Applications have been made by Messrs. Benham & Sons, Ltd., in respect of Patent No. 26,347/12, granted to Albrecht for electric heating devices, and by Messrs. S. Dreyfus & L. Gaisman (Hooley Hill Rubber and Chemical Co.) in respect of Patents Nos. 11,530/13 and 11,615/13, granted to Farbenfabriken vorm. Friedrich Bayer & Co., and Nos. 12,777/13 and 12,661/14, granted to Newton for the same firm for the vulcanisation of caoutchouc.

Sterling Telephone and Electric Co., Ltd.—Mr. Guy Burney, managing director of this company, has issued, under date January 1st, 1917, the following circular:—

"We have the pleasure to announce that the enemy shares of this company have now been acquired from the Public Trustee by Sir John Bethell, Bart., M.P., and his friends. Sir John Bethell has consented to act as chairman of the company. Sir Thomas Bethell (brother of Sir John) and C. S. Syrett, Esq., have also been elected directors of the company. The whole of the shares are now entirely held by British-born subjects. The difficulties associated with the enemy share-holding having been removed, we trust we may confidently look forward to a continuance of your friendly relations and support."

COLONIAL TELEGRAPHS AND TELEPHONES.

By R. W. WEIGHTMAN, M.I.E.E.

(Abstract of paper read before the Institution of Electrical Engineers.)

(Concluded from page 53.)

The local telephone development in some parts of South Africa has been quite phenomenal, especially in the mining districts of the Rand.

In Canada, the Bell Co. have central-battery manual systems in their larger exchanges, and in exchanges below 500 or 600 lines they use magneto boards. They have no automatic exchanges. The practice of the Manitoba Government Department is on similar lines.

In Alberta and Saskatchewan the Government exchanges at Calgary, Medicine Hat, Lethbridge, Regina, and Saskatoon are equipped with the Strowger automatic system, as is also the municipal exchange at Edmonton. This latter exchange was started in 1907 with a 500-line installation, but is now for 10,800 lines, of which 9,300 are connected. It is spread over four exchanges and an area of roughly 20 square miles. All other exchanges in these two provinces are magneto except two central-battery manual exchanges at Saskatchewan.

Dry cells are used on all subscribers' magneto instruments throughout Canada.

The block and alley system of distribution is generally followed.

Superimposed telegraph circuits, which are usually leased to the telegraph companies, are arranged on both "simplex" and "composite" systems. The "simplex" is the well-known system which gives one Morse circuit superimposed on one telephone pair by means of repeating coils. The "composite" gives two Morse earthed circuits, which can be worked either single or duplex, and one metallic telephone circuit on one pair of wires. The theoretical connections of a terminal composite set are given in fig. 4. The condensers

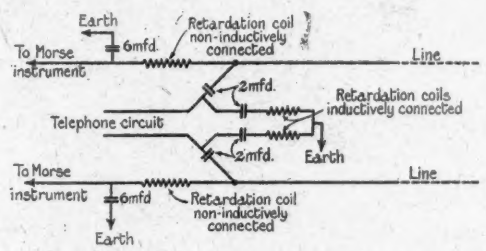


Fig. 4.—"Composite" System of Superimposing Two Telegraph Circuits on Telephone Pair.

and retardation coils on the Morse arms prevent the telephone currents from passing through these arms, and they also so flatten the telegraph currents that the "thump" which would otherwise be heard in the telephone is reduced to a minimum. The condensers and retardation coils connected in shunt with earth off the telephone circuit have the effect of reducing the momentary telegraph currents that pass from one Morse circuit to the other through the telephone circuit. These earthed branches have a high impedance to telephone currents and a low impedance to telegraph currents, so that the latter are largely shunted to earth. The condensers in these branches prevent the earths on the retardation coils from interfering with the local telephone calling-signals. The telephone transmission loss due to the introduction of a repeating coil at each end of a telephone circuit on the "simplex" system is equal to about one mile of standard cable, while the loss on a circuit equipped with a "composite" set at each end is equal to about ¾ mile of cable.

The minimum speech efficiency on the long-distance circuits varies under the different administrations, but it ranges from 30 to 36 miles of standard cable. The general dryness of the climate contributes to a high standard being attained.

Long-distance lines are equipped with lightning dischargers on the poles at suitable intervals, and where these wires are taken into an office or testing station it is a common practice to place the dischargers one or more poles away on each side of the office. The "Chapman" discharger shown in fig. 5 is a type much used for this purpose.

Branching joints on underground cables are of the lead Y-type, and all joints, both straight and branching, are treated with paraffin wax. In making a straight joint the lead sheath is removed from the ends of the cable for a distance equal to the length of the lead sleeve. The core is bound tightly with strips of muslin at the end of each cable sheath, the binding being packed close to the sheath so as to prevent the wires being cut by the edge of the sheath. The exposed conductors are thoroughly "boiled out" by pouring hot paraffin wax over them with a ladle until all traces of moisture are removed and the binding is thoroughly saturated with paraffin. Enough paraffin enters the sheath to form a seal, which protects the cable against moisture while the joint is being made. The temperature of the paraffin is above that of boiling water, but it must not be high enough to scorch or make brittle the paper insulation. In "boiling out" the cable it is the rule to work from the cable sheath towards the ends of the conductors. The jointing of the wires is done in the usual way, the joints being distributed along the whole length of the splice. The whole of the jointed wires are again "boiled out" until all traces of moisture have been removed. The splice is then wrapped with strips of muslin and compressed until the lead sleeve will just slip over the splice. The splice is again "boiled out," and this operation is again repeated after the final wrapping is completed, the drying out being continued until air bubbles cease to appear on the splice. The lead sleeve is slipped over before the splice has had time to cool and is wiped on to the cable sheath at each end.

The splice on a dry-core cable is undoubtedly its weakest point, but this form of joint when carefully made is so reliable that breakdowns are of very rare occurrence. It is in almost general use in the United States.

There is no through communication yet between the Eastern and Western shores of Canada. There is a break of 600 miles between Fort William and Kenora in which there is no telephone line at all, and the Rocky Mountains form another break between Alberta and British Columbia. The longest lines regularly in use in Canadian territory are those between Montreal and Windsor, and Montreal and North Bay, distances of about 600 miles. Loading coils are in use on both open-wire and underground sections of the long distance circuits. Communication is given with a large number of places in the United States through the trunk lines of that country, the longest distances being Montreal to San Francisco, 3,800 miles, and Toronto to San Francisco, 3,200 miles. (Communication has since been arranged between

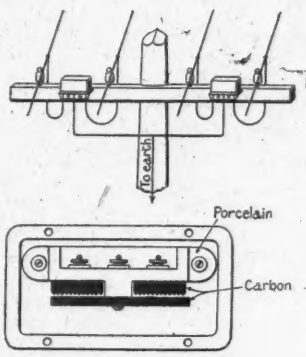


Fig. 5.—Chapman Lightning Arrester (Canada).

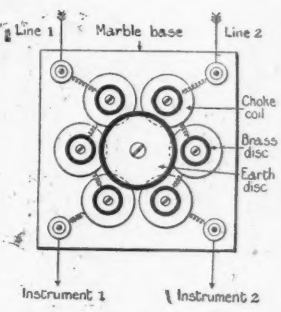


Fig. 6.—Lodge Discharger, Natal Pattern.

Montreal and Vancouver, *viâ* the American trans-Continental line, a distance of about 4,000 miles.)

The telephone development of Canada is higher than that in any of the other Dominions or Colonies. For the whole of the country the average number of telephones per 100 of the population is 6.5. In British Columbia the average is as high as 11, while in Manitoba and Alberta the figures are 10 and 8 respectively.

Probably no country in the world has taken up automatic telephony so whole-heartedly as the Australian Commonwealth. In 1912 the chief electrical engineer personally investigated the systems then in use in America and Europe. His report, dated October 10th, 1912, deals in a very thorough manner with the comparison which may be made between manual and automatic systems. In comparing the semi-automatic with the full automatic he contended that the view that it is desirable to interpose an operator to control the series of operations that have to be made, and to check and correct failures when these occur, is wrong, and he declared himself emphatically in favour of the full-automatic for Australia. Since then important headway has been made; full-automatic equipment has been installed in 10 exchanges, the largest of which is Perth, with over 3,000 subscribers. Six other exchanges are in course of construction or approved, tenders have been invited for a further 18, and 14 others are under consideration. The exchanges so far opened are all equipped with the Strowger system, but both the Siemens and the Western Electric Co.'s systems are to be tried.

Both central-battery and magneto exchanges are in use. Distribution from all the larger exchanges is effected by means of underground cables. On very small exchanges open-wire distribution is adopted. Rubber-covered paper-core aerial cable has been used in certain of the States, but it has not proved satisfactory.

Selective 4-party line services are provided on the central-battery exchanges, and code-ringing party lines on the others, and on lines in country districts.

Both wet and dry cells are in use on subscribers' instruments, but the Post Office Leclanché cell with powdered depolariser is now being adopted.

There is a fairly extensive trunk system within the indivi-

dual States, but the only capital cities as yet connected are Melbourne-Sydney (595 miles) and Melbourne-Adelaide (487½ miles). On both these circuits Morse duplex is superimposed and worked regularly. Loading coils have not yet been introduced into the Commonwealth. The percentage of telephones to the population at the end of last year was 2.721.

New Zealand was very early in the field in establishing telephone exchanges at its principal centres, and many of the exchanges installed between 20 and 30 years ago are still in operation. Many of the larger exchanges have become quite inadequate for present requirements, and the question of substituting more efficient systems has been before the authorities for some years past. The introduction of the central-battery manual system was contemplated, and three Western Electric central-battery exchanges were installed, but the administration hesitated to introduce this system generally in view of the development of automatic systems. In 1911 the chief electrician of the department was deputed to inquire into the various systems in use in America and Europe, and as a result of very exhaustive investigations he recommended the adoption of automatic exchanges for several of the principal towns. Experiments were carried out with several automatic systems available at the time, and the Western Electric Co.'s full-automatic system was decided upon as being the best calculated to meet the varied services of the Dominion. Contracts were entered into with this company for exchanges for the Wellington and Auckland telephone areas, and for separate single exchange installations for Masterton, Hamilton, Oamaru, and Blenheim. The ultimate capacity of each of these exchanges is the same, viz., 1,800 subscribers' lines, and 200 junction lines for special services.

At Wellington the system will have three main exchanges with immediate equipment for 4,000, 2,500, and 600 lines (ultimate capacities 8,000, 4,000, and 2,000 respectively). In addition, three sub, or "satellite" exchanges off the largest main exchange, with capacities from 200 to 600 lines, are contemplated, the ultimate capacity of the whole system being 20,000 lines, and accessory junction lines. Two of the main exchanges are now being installed, and but for delays caused by the war these would have been in operation by now. At Auckland the arrangements will be on similar lines with four main exchanges and two "satellite" exchanges, the total ultimate capacity being the same as at Wellington. It is not too much to say that before many years have passed all the important exchanges throughout the Dominion will be "automatic."

The longest speaking circuit is that between Wellington and Auckland, a distance of about 420 miles. This is obtained from two 400-lb. copper wires which are used for quadruplex telegraph purposes during the daytime. At night-time—after 6 p.m.—they are used as a telephone trunk circuit. In many cases telegraph circuits are superimposed on the telephone wires, and phantom telephone circuits are also obtained. Loading coils have not so far been installed. The standard of speech on trunk lines is the equivalent of 30 miles of standard cable. The number of telephones per 100 inhabitants is 4.6.

LIGHTNING DISCHARGERS AND PROTECTORS.

To-day it is generally, although by no means everywhere, recognised that the proper place for the lightning discharger is outside the building, or if inside, it should be placed as near the point of entrance of the wires as possible.

No form of lightning discharger known to the author will save wires if they are actually struck by lightning; they may be merely severed by the discharge, or short lengths of wire may actually disappear, deflagrated by the current, and such cases are not of rare occurrence on open country lines. The discharges the engineer has to protect himself against are those due to induction.

In Natal the author carried out a long series of experiments with the object of proving what types of protectors were best suited to the different working conditions there.

For protection at out-of-the-way offices where unreliable attendants are in charge, the carbon discharger is not always suitable. At a station of this class a discharger is wanted which will give protection without earthing the line. For this purpose the Wurts discharger was found to be most reliable. The type used had three cylindrical pillars of non-arcing metal with serrated surfaces, set in a porcelain base mounted on an iron bracket. The cover is of zinc. It will take one line wire on each outside pillar, the middle pillar being connected to earth. The connecting wires from the line wires were led as straight as possible, without spirals, twists, or sharp bends, and the earth was made as short and direct and as good as possible. With all types of dischargers it is essential that the greatest care be given to these points. The insulated wires running into the office were spiralled a few turns where they left the line wires, and the slight impedance thus introduced formed an effective choke to the discharge. Where dischargers of this type were employed and properly installed all other protective devices, such as fuses, spindles, and reels with fusible wires on them, were dispensed with.

This discharger is equally satisfactory on sections of line where lightning is specially troublesome, as on high, exposed tracts of country. Connected to the wires at suitable intervals they save them from damage due to heavy lightning charges flashing from the wires to the arms and poles, and they relieve the discharges at the terminal stations.

On railway signalling lines on which metallic circuits were used to minimise the effects of lightning, the discharger shown in fig. 6 was used. On these circuits working had to be carried on at all times, as any interruptions resulted in the disorganisation of railway traffic. This discharger is on the Lodge principle, and is the most effective discharger known to the author. It is, however, very expensive, and prohibitively so for a number of wires. The Wurts discharger might have been quite adequate, but it was introduced on other lines subsequently to the adoption of the Lodge discharger on these railway circuits, and the latter served the purpose so well that any risk there might have been in trying the other was never undertaken. This type of Lodge discharger is constructed with two separate series of three discharge disks and choke coils for the line wires. The central disk is earthed. The two line wires are connected to the two top disks, and below each disk there is a choke coil containing a number of turns of fairly heavy wire. The main discharges take place at these disks. The two succeeding disks on each side are similarly arranged with choke coils. With these dischargers in use the signalling instruments were operated in the heaviest lightning storms and not in a single instance during several years of operation did a discharger fail in its duty. As the edges of the line disks were burnt away by the discharges, they were turned slightly round to give fresh points for discharge, and it only rarely happened that a disk became so burnt as to require replacement.

NEW ZEALAND TRADE.

A careful analysis of New Zealand's import trade during 1915 by Mr. R. W. DALTON, H.M. Trade Commissioner in New Zealand, has been published by the Board of Trade (Cd. 8,415. Price 4½d. Wyman & Sons, Ltd.) Mr. Dalton remarks that the United Kingdom maintained its trade at a surprisingly high level, having in mind the difficulties under which manufacturers were working. While this fact is justifiable cause for gratification, it should be remembered that, though the results are not as yet remarkable, it is an undoubted fact that the manufacturers of certain countries not so much affected by the war have taken the opportunity of abnormal conditions to endeavour not only to capture trade which was formerly held by enemy countries, but also to establish themselves in face of competition, from whatever quarter. To this end they have been assiduously applying themselves to the appointment of agents and the organisation of selling campaigns.

The results of these activities may be more apparent in the statistics for the year 1916. Meanwhile, it may be regretted that, probably as a result of their being so hard pressed in other directions, manufacturers at home who are determined to appoint agents in this market show a disposition to put off doing so until after the war. The advisability of so doing must be very seriously questioned, for, with foreign manufacturers diligent in their search for good agents, and with agents doubtful as to what the after-war conditions may be—and, therefore, disposed now to take offers which may be made to them—it would seem to be a dangerous policy to defer until more normal times the first steps towards the preparation of a selling organisation.

While due credit must be given to the majority of New Zealand buyers for their loyalty to former suppliers, the fact that, in times such as those through which our manufacturers have passed, they should be able to maintain their trade at this high level in a market so far distant speaks very eloquently for their enterprise, for the efficiency of the shipping lines, and for the protection of the Navy.

It was only to be expected that suppliers nearer to the Dominion markets should be able under the circumstances to increase their trade with this market, for the time being, at any rate. Australia and Canada have increased their percentage shares of the competitive trade by 1.7 and 1.2 respectively, so that the share of the Empire in the trade of the Dominion is even greater than it was in the previous year. The percentage share of the United States in 1915 increased by 2.0, and that of Japan, though small, by 0.9.

The two latter countries in particular have been actively establishing organisations in this market on a more or less permanent basis. Nevertheless, bearing in mind what the manufacturers at home have been able to accomplish during the war, and the fact that productive methods have been very much improved, there seems ground for believing that, if during the war they do what they can to maintain their touch with the market, when the war is over they will be able to regain their former position, if not to strengthen it. There is also ground for presuming that a part, at least, of such success as foreign countries may have had in this market during the war is merely temporary, and will automatically disappear when manufacturers at home are again in a position to supply. For the rest, it has still to be seen how far the war has increased the competitive ability of British manufacturers; but it may be presumed that they will be on a more favourable basis than ever before. Added to this, there is the undoubted fact to be taken into account that

the buyers of this Dominion are more than ever prepared to purchase British goods in preference to those of any country, and that this attitude, arising primarily from patriotism to the Mother Country, is strengthened by a realisation, as a result of the war, that the support of Empire undertakings is desirable, if not essential, in the best interests of the Dominion. If, in the meantime, manufacturers can spare the time, and will take the trouble, to explain to customers exactly what they are doing for the war, and how the war is interfering with their ordinary trade, the patriotism of the Dominion is such that a clear understanding will produce a marked effect on business.

Dealing particularly with machinery and machines, Mr. Dalton remarks that in this trade, production in which in the United Kingdom has probably been affected most of all industries by the war, the share of the United Kingdom in the total has declined from 59.0 per cent. to 55.4 per cent. It cannot be denied, however, that the United Kingdom's position in this trade before the war was not at all satisfactory. In relation to other trades, the percentage of the imports supplied by the United Kingdom was low, and there are certain important lines in which United Kingdom manufacturers are quite outclassed by their competitors. In consideration of the various items it will be noticed that, almost without exception, those lines are either lines which have been the subject of comparatively recent invention or development, or are such as are particularly adapted to Colonial conditions, and are in a great measure different from the articles required to serve similar purposes in the United Kingdom. The inferences to be drawn from these conditions would appear to be hardly complimentary to the ability and efficiency in designing and marketing of United Kingdom firms. As there can be no doubt that the manufacturers of the United Kingdom are second to none in manufacturing ability, it can only be supposed that their real fault has lain in failure to ascertain modern needs in such countries as New Zealand, and to manufacture to meet those needs, as well as in failure to organise an adequate selling campaign.

It is such conditions as these which have doubtless given rise to many of the criticisms of the efficiency of British manufacturers which one hears. Most of these criticisms are entirely unreasonable, and many are the product of hearsay or the outcome of a disposition, becoming all too popular, to imagine that the British manufacturer generally is effete as a serious competitor for the trade of the world. One cannot, however, consider the statistics under this class without concluding that in certain sections of this trade, at least, there is need for some further enterprise on the part of United Kingdom firms.

The leading competitor is the United States, but it may, perhaps, fairly be said that if the reason why British firms do not secure more of this trade is because they are not sufficiently enterprising, it is not equally true that the fact that American firms do secure it is a proof of their enterprise being greater. In many of the lines in which American firms are found to be predominant, the articles are of a nature which have had to be made in the United States to meet the needs of that country, and, as the conditions are much the same in this Dominion as they are in America, the same articles will suffice. The conclusions to be drawn from this are that such trade as the United Kingdom does secure in these lines is, and will be, the result of greater enterprise than that of their American competitor, and that the belief existing here that American firms are more enterprising than British is to this extent, at least, fallacious. The fact is that American production is so much standardised that in the majority of cases, perhaps, manufacturers in that country would be even less disposed to alter their patterns than British firms—the trouble is that they are not so frequently asked to do so, because, for the reasons already indicated above, there is not the same need.

The above remarks are made well understanding that conditions have changed in the United Kingdom since the war, and that there is reason to hope that when the war is over, manufacturers at home, having extended their plants, and finding that there is need of trade to keep them going, will turn their attention to many of these lines. If they do, there is no doubt that the trade in New Zealand in goods of the class now under consideration will experience a change.

PRINCIPLES INVOLVED IN COMPUTING THE DEPRECIATION OF PLANT.

BY F. GILL AND W. W. COOK, MEMBERS I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

IT is not very satisfactory that engineers should hold such divergent views on so important a question as depreciation. Possibly this is due to the subject being regarded as one for the accountant alone, but in our view depreciation concerns the engineer, the financier, and the accountant, and no one of the three is competent to settle the question in any particular case, as, in order to obtain correct results, there must be co-operation between the three.

By the term "depreciation" is intended to be covered: (1) Provision for the diminution in value of plant in place and working (that is, its loss in value to the owner as a continuing plant), by reason of causes *outside* his control, such as age, wear, and accidents; this provision is hereinafter called "renewals." (2) Provision to enable the owner to take plant out of commission before its physical life is exhausted in cases where, from either progress of the art or growth of the business, it is economically advisable to do so (that is, by reason of causes *within* his control); this provision is hereinafter called "improvements."

It should be noted that the expression "renewals" denotes provision in respect of actual expired capital outlay, while the expression "improvements" denotes provision to enable plant to be destroyed while still valuable.

The function of the engineer in this matter is to provide the information necessary regarding the plant, such as first cost, residual value, and life.

The function of the financier is to provide information regarding the money, the amount available, the rate at which it can be borrowed, and the rate that can be obtained for the loan of it.

The function of the accountant is to provide accurate records based on the decisions arrived at, and to see that the real results are neither disguised nor hidden.

All three must come to a common decision, and each in any calculations he has to make must work to it, otherwise nothing but chaos can result.

When preparing a specification for plant to achieve certain definite results, there is usually more than one way of arriving at the desired end, and skilful judgment in the selection from among the alternatives must be exercised.

While the first cost of alternative plans is highly important, in most cases it is nothing like so important as the annual charges, and generally the decision as to which alternative to use can be made upon consideration of the annual charges alone.

Annual charges are composed of four principal parts:—

1. Return on capital outlay.
2. Depreciation—as already defined.
3. Maintenance, the cost of keeping the plant in as good condition as is desirable, but not of renewing it.
4. Operation—the cost of working the plant.

It is desirable to insist upon the importance of the utmost accuracy in the preparation of the annual charges. If the cost of any plant is to be judged by its annual charges, they must be the true annual charges, and one cannot express these by the single statement that they are, say, 14 per cent. per annum of first cost, unless either the cost is uniform each year, or the rate mentioned is an equated rate taken over the prospective life of the plant.

The sums required for return on capital and depreciation both depend upon the treatment of the capital account and the depreciation fund; in fact, these two are so intimately connected that their costs cannot be treated independently.

For the purpose of this paper there are two lives which must be defined:—

(*a*) Physical Life, that, is, the period during which the plant would continue to perform satisfactorily the service to which it is adapted, if allowed to do so, but subject to all causes *outside* the control of the owner, such as wear and tear or accidents.

(*b*) Economic Life, that is, the period of physical life shortened by causes *within* the owner's control, such as desire for economy, improvement of service, the taking out of plant because a greater capacity is required.

It is necessary to distinguish quite clearly between these two. The physical life affects the amount to be put aside each year for renewals, and since by definition the plant can perform its service satisfactorily during the whole time, there is no compulsion to renew before the conclusion of the physical life.

The renewals fund thus ensures that the money invested in plant is always represented by the assets, provided that none of it is voluntarily destroyed.

In order that the owner of the plant may be always in a position to take advantage of developments and still be in a sound position, it is necessary to have a special fund available for the purpose, and such a fund is referred to in this paper as the improvements fund.

As such a fund is necessary for the successful conduct and progress of the business, the annual contributions are, in a continuing business, part of the annual charges against the plant.

The distinction between the renewals fund and the improvements fund must constantly be borne in mind.

The charges to the renewals fund represent actual expired capital outlay each year, and consequently are the measure of the diminution of the value of the plant in place considered as a structure, whilst the improvements fund enables plant to be superseded before its physical life is ended, and ensures that when this is done the value of the assets shall always represent the invested capital.

The methods of arriving at the deduction to be made for any plant which has already been in existence some time may be divided into two classes:—

(*a*) Based on a detailed examination of the plant and an individual assessment of values for each item.

(*b*) Based on an estimated life which the various classes of plant will have under a given standard of maintenance, and providing for the diminution in value by writing off or setting aside a proper sum in respect of each expired year (or other portion) of life.

When carefully examined there is really no sharp dividing line metween these two methods.

In the case of detailed examination (*a*), proper weight can be given to condition, but physical examination alone will not enable a proper deduction to be made for the depreciated state of the plant. In some cases, for some years, the plant shows no sign of wear or decay, yet obviously some provision ought to be made for the expired life during these years. It is usual, therefore, and necessary, to estimate the first cost, life, age, and residual value.

If, as in method (*b*), the bulk is considered instead of the individual items, the life and age can be estimated with much greater certainty, while consideration of the amount spent on repairs and upkeep, supplemented by inspection, will give the condition.

The measurement of the effects of wear and tear and the passage of time is essentially a financial operation, and no satisfactory solution can be found without going through the steps of establishing the first cost, residual value, life, and age.

It is often said that one cannot say how long a certain plant will last; but this is not a sufficient answer. One must estimate the life if there is to be any attempt towards scientific treatment in planning.

One cannot neglect capital charges, *i.e.*, return on capital and provision for depreciation; and the latter depends very largely upon life.

Those who say the life cannot be estimated, and take, say, 10 per cent. as capital charges, do, in fact, estimate the life, though they do not state the period, and they do so without taking the necessary precautions to estimate it correctly, because for any particular rate of return on money, and with a given residual value, 10 per cent. per annum can only be arrived at by one definite life.

Further, without estimates of lives one cannot logically arrive at one common rate for capital charges for various classes of plant capable of living for various periods. It follows, therefore, that of necessity estimates of life must be made.

Most of the examples in the paper which concern economic life have been worked out on a basis of :—

First cost	£100
Residual value	13 per cent.
Economic life	19 years.

and the examples which concern physical life on a basis of :—

First cost	£100
Residual value	2 per cent.
Physical life	25 years.

In both cases interest where taken is at 5 per cent. per annum.

Let the essential conditions be that the plant shall be charged with a yearly sum sufficient to :—

(1) Pay for all maintenance.

(2) Pay all operating expenses.

(3) At the end of the physical life, renew the capital outlay on it.

(4) Provide sufficient money to enable the company to take advantage of improvements in the art, and take out of commission, when desirable, plant which still has some years of life left in it.

(5) Pay the company an agreed return on the money invested, say, 5 per cent. per annum.

(6) Let it be also assumed that the capital is £100, and that it and the plant do not increase during the whole time.

Maintenance and operating costs are assumed to remain constant and can be neglected.

The money received each year in advance for renewals and improvements cannot remain idle; it must be used to repay the capital gradually, or be lent at interest to someone out side the business.

Since the matter can be treated in different ways, it is necessary to consider what tests shall be required of the various methods. There are two: (1) The total cost of all the annual charges for the economic life of the plant shall not exceed the real cost; and (2) the incidence of the annual charges shall not be such as to cause anomalies in the conduct of the business in different years or periods, unless such incidence is due to some plant condition.

In the typical methods to be examined, it is assumed that the first cost is £100, the residual value at the end of the economic life £13, and the economic life 19 years.

The present value of all payments, £94.86, is the total cost, independent of any method, to be used in the first test of any method.

There are various methods of treating the provision for depreciation, but substantially they reduce to the following : —

(1) Maintenance Method, wherein no regular sum is put aside, the plant being maintained and renewed out of revenue expenditure.

(2) Reducing-Balance Method, wherein a uniform percentage is deducted each year off the reduced capital cost.

(3) That usually called the Straight-Line Method, wherein the annual charge is the ratio of one year to the total time or life.

(4) Sinking-Fund or Annuity Method, wherein value is given to the interest the fund will earn until it is wanted.

(1) The Maintenance Method affords no means of calculation; it is bound to be irregular, and since no charge can be made until a renewal actually takes place, the method is always in arrear unless and until a complete renewal is effected.

(2) The Reducing-Balance Method is very frequently employed to ascertain the amount to be allocated for depreciation at the end of a year. The first cost being assumed at £100, the residual value 13 per cent., the economic life at

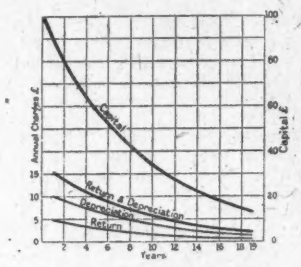


FIG. 1.—ANNUAL CHARGES. REDUCING BALANCE METHOD.

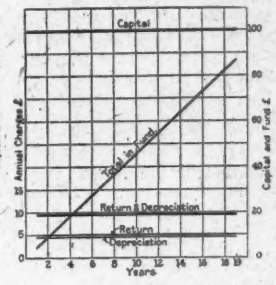


FIG. 2.—ANNUAL CHARGES. STRAIGHT-LINE METHOD AS FREQUENTLY POSED.

19 years, it will be necessary to apply a rate of 10.18 per cent. per annum to the reduced balance to extinguish the £87 during the life, and the costs for return and depreciation are shown in fig. 1.

This method results in a relatively heavy charge in the early years, and a very light one in the last years. The present value of the whole series of payments is £94.86, and so this method satisfies the check as to total cost; there only remains the check on incidence.

(3) The Straight-Line Method has been strongly advocated and requires extended consideration.

As usually posed, it is simplicity itself. £87 is to be found in 19 years; therefore, all that is required is £4.58 per annum for depreciation and, with £5 for return, the total charges for these two heads are £9.58 per annum, as shown in fig. 2.

This table does not, however, pass the test of total cost; the present value of 19 annual payments of £9.58 each at 5 per cent. is £115.77, instead of £94.86, an excess of £20.91.

If £4.58 be set aside annually, there will, of course, be £87 accumulated at the end of the 19 years; but since it is not prudent to leave money idle, it is plain that interest ought to be, and will be, earned by the money so set aside annually.

If interest is taken at 5 per cent. per annum and added to the growing fund, there will be at the end of the 19 years not the £87 required, but £139.84, so the yearly payments must be reduced below £4.58 per annum until the amount

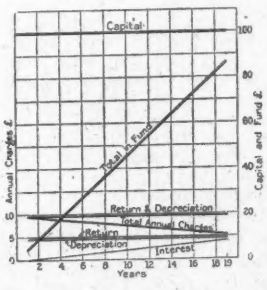


FIG. 3.—ANNUAL CHARGES. STRAIGHT-LINE METHOD IN PRACTICE.

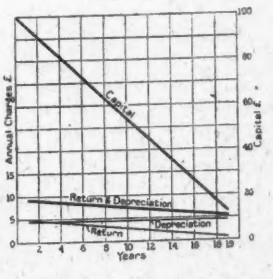


FIG. 4.—ANNUAL CHARGES. STRAIGHT-LINE METHOD. PART OF CAPITAL REPAID EACH YEAR.

is just sufficient to accumulate only the £87 required, and this needs a yearly payment of £2.85 for the 19 years.

If the earned interest be not added to the fund, but credited to the general revenue account, as is generally the practice of those who uphold the straight-line method, the effect is that the revenue is increased thereby, with the result that a higher return on the capital is obtained, the interest earned by the depreciation fund not being required for the plant. But this is a violation of the hypothesis, because a stated return on capital was to be earned, no more and no less.

This case is shown in fig. 3. Here, again, the present value of all the payments exacted for the plant is too great, being £115.77.

If the straight-line law is followed, but instead of accumulating a fund the capital is partly repaid each year, the present value is seen to be correct at £94.86, and there remains the question of incidence. Fig. 4 shows this.

(4) Annuity Method. Fig. 5 shows the case treated as an annuity, by which each year a part of the capital is repaid and a return is paid on the capital outstanding. Here the total annual charge is uniform at £7.85 per annum, made up of the decreasing return component and an increasing depreciation component. At the end of the life all the capital has been repaid, except £13, which will be found by the sale of the plant. The plant gets the benefit of interest, because as capital is repaid the return thereon ceases. The present value of the series of payments is £94.86.

(4) Sinking-Fund Method. Fig. 6 shows the case treated by a sinking fund; in this instance the capital remains fixed at £100, and a fund is built up gradually against the end of life, at which time, and not until then, the money will be required either to repay the capital or to replace the plant.

Here the total annual charge is uniform at £7.85 per annum, made up of uniform charges each year both for return and for depreciation. The present value of the series of payments is £94.86.

The depreciation fund is not required until the end of the life, and, of course, earns interest in the meanwhile; in this instance the interest is added to the fund, and because of that addition the annual charges are reduced.

The advocates of the straight-line method have to choose between figs. 2, 3, and 4.

They cannot adopt fig. 2, because that requires either that no interest is earned by the money paid annually in advance, or that interest is earned but not disclosed, each being an untenable position.

They cannot adopt fig. 3, because that requires the plant to pay an enhanced annual charge under the plea of its

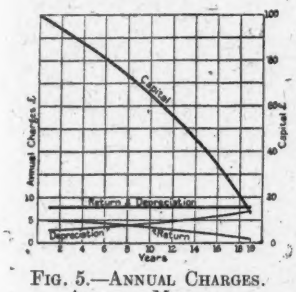


FIG. 5.—ANNUAL CHARGES. ANNUITY METHOD.

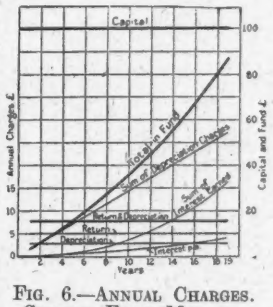


FIG. 6.—ANNUAL CHARGES. SINKING FUND METHOD.

being required to provide for depreciation, although, as a matter of fact, the enhancement is used to give the owner a greater return.

They are not likely to adopt fig. 4, because that requires a charge which reduces each year till the end of the life of each

TABLE I.—PRESENT VALUE OF THE ANNUAL CHARGES FOR 19 YEARS BY THE VARIOUS METHODS SHOWN.

Method.	Figure No.	Annual charges.	Present value.
		£	£'
Real requirements	—	—	94·86
Reducing balance	1	15·18 to 2·19	94·86
Straight line as frequently posed ...	2	9·58	115·77
Straight line in practice	3	9·58	115·77
Straight line if proportion of capital is repaid each year	4	9·58 to 5·46	94·86
Annuity	5	7·85	94·86
Sinking fund	6	7·85	94·86

portion of plant, and then increases and again commences to fall. It would be impracticable to base any rates on this table.

Tabulating the present values of the whole transaction by the various methods, we have Table I.

Now, it is obvious that each method produces exactly the required present value, except that which takes up the position that interest will not be earned on the money received each year and in advance of being required, or while admitting that interest will be earned does not credit it to its source.

Examining the methods shown in Nos. 4, 5, and 6, each of which has a present value of £94.86, for the test of incidence, Nos. 1 and 4 require an annual charge which varies each year, while Nos. 5 and 6 have charges wihch are steady each year.

There is no condition as regards the plant which requires this varying annual charge, and certainly no plant condition which would enable one to distinguish between the varying annual charges in Nos. 1 and 4.

If there is some real reason for varying annual charges, of course they must be faced; but if they are untrue, it is foolish to cumber a forecast of annual charges with a varying scale.

The reducing balance method (No. 1) is seen to be one of convenience, and not of fact, because if it were really correct that the annual charges vary in such a marked fashion, *e.g.*, 1st year 15.18 per cent., 6th year 8.87 per cent., 12th year 4.66 per cent., then either there must be some counterbalancing increasing cost, or the charge to a consumer for the use of the plant would require to be a reducing one.

There is no such reducing charge in practice; consequently, if the steady charge to the consumer is sufficient to give a return of 5 per cent. in the first year, then the same charge will give 15.8 per cent. return in the 6th year, 39.3 per cent. in the 12th year, and 94.8 per cent. in the 19th year.

The same reasoning applies to the method shown in No. 4; in ordinary practice there is no such reducing charge, except in book-keeping, and that has its foundation in convenience or prudence, and not in the actual requirements of the plant.

On the other hand, both the annuity and sinking-fund methods are correct in amount, satisfy all real requirements demanded by the plant, and, being uniform, can be easily handled.

In practice it is not usual to repay the capital fractionally each year; the money set aside for depreciation is generally accumulated until wanted, and the sinking fund method satisfies all conditions of the problem so far.

(To be continued.)

LEGAL.

SECRET PROCESS IN RUBBER MANUFACTURE.

IN the Chancery Division on Thursday, January 11th, Mr. Justice Peterson continued the hearing of the action brought by the Alperton Rubber Co. against Manning and the Belgium Tire Co. to restrain the disclosure of a secret process for the hardening of rubber, so as to render it suitable for electric insulation and other purposes. The allegation was that the defendant Manning, while in the plaintiffs' employ, obtained their formula for a hardened rubber called Alperlite, which they had introduced as a substitute for the German Stabilit, and had disclosed it to the Belgium Tire Co., who were now manufacturing a similar substance.

Mr. Hughes, K.C., and Mr. Hodge appeared for the plaintiffs, Mr. Herbert, K.C., and Mr. Manning for the defendant Manning, and Mr. Tomlin, K.C., and Mr. Deighton Pollock for the Tire Co.

Opening the case for the defence, MR. HERBERT said that a winding-up order had been made against the plaintiff, and the Official Receiver, who was acting as liquidator, after considering the matter, did not feel in a position to go on with the action, which was being continued by the debenture-holders. Mr. Herbert also pointed out that Mr. Hughes had not thought it worth his while to go on with the claim against the Tire Co. for inducing the defendant Manning to leave plaintiffs' employ. His submission was that on the evidence already given, and the evidence he should call, there was no justification for the claim in the action against Manning. His case was that Manning had acted in a perfectly *bona fide* manner. The formulæ he had been using while with the plaintiffs were part of his technical equipment, and he was entitled to use them wherever he might go. Really the only important formula was that which related to Stabilit, and the question turned upon whether Manning had taken that formula and communicated it to the defendant company, and that company was manufacturing something from a formula supplied by Manning, which he had obtained in confidence from the plaintiffs. He understood that the Belgium company were not only not using that formula, but were going to prove that they were using quite a different formula. However that might be, the plaintiffs' evidence had not connected Mr. Manning with communicating any process to the Belgium Co. The action was brought entirely under a misapprehension. The plaintiffs thought that Manning was in the employ of the Belgium Tire Co., and had taken this formula to them, whereas he was acting as a commission agent, and had merely placed orders with them.

MR. TOMLIN said that his case was that the Belgium company never had any information from Mr. Manning. They had been experimenting with a view to finding a substitute for Stabilit, and had found one. The case made against them was that they had received information from Mr. Manning, but there was no evidence as to that of any sort or kind. The case made against them was one of suspicion, and nothing else. Mr. Manning denied in the witness box that he had communicated any information obtained while in the plaintiffs' employ. He was a costs clerk with the plaintiff company, and had nothing to do with the technical part of their business. Nothing whatever was said about secrecy when he was engaged.

Evidence was called on behalf of the Belgium company to show that the formula used by them was not the same as that used by the plaintiffs.

The case is proceeding.

PETITION FOR REVOCATION OF PATENT.

IN the Chancery Division, on January 11th, Mr. Justice Sargant again heard an application on behalf of the respondent, Mr. Ralph Hancock, to a petition by The James Keith & Blackman Co., Ltd., for the revocation of his patent relating to centrifugal fans.

MR. J. H. GRAY applied to have the petition held over, so that it should not come on for trial before the June (Trinity) sittings of the Court. He said the patentee was at present in America upon

Government business, and there was no probability of his being able to return soon, but his solicitors were prepared to give an undertaking that if he returned before the time indicated for the hearing, they would notify the petitioners to that effect.

His LORDSHIP granted the application on the respondent's solicitors undertaking that if they knew of their client's intended return, they would let the other side know.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

UNITED STATES OF AMERICA.—A recent decision by the Board of General Appraisers entitles crude india-rubber in sheets—imported in the form of sheets about 12 in. wide, 20 in. long, and ¼ in. thick—to entry free of Customs duty under the Tariff Act of 1913.

ARGENTINE REPUBLIC.—A Presidential Decree, dated October 17th, regulates the Customs procedure in connection with the clearance of samples at Argentine ports. Parcels of samples may not exceed 10 kilogs. (22 lb.) in weight, otherwise they will be regarded as "cargo," and placed in warehouse at the port of entry. Only parcels containing articles which have been so defaced, &c., that they are useless for trade purposes may be cleared as "samples without value." When such samples are imported in trunks or other containers subject to duty, the importer must pay or enter into a bond for the amount of duty leviable.

Parcels containing samples of kinds not included in the preceding paragraph, or which may be classified under any heading of the Valuation Tariff, are to be regarded as "samples of (commercial) value," and, as such, shall pay duty in accordance with the values established by the Appraisers, *provided that the samples consist of separate pieces of goods which are commonly imported in sets*, and *that there are only one or two pieces of each class of article;* or—if the samples consist of articles of miscellaneous kinds, classes, or qualities in the form of one or two pieces to illustrate each kind or quality—provided that such samples are those of goods which are of kinds commonly imported in larger quantities and in parcels containing only one kind or quality. In this case, the interested party must declare in detail the pieces or objects which he wishes to import, and he may apply for permission to examine the contents of the parcel if such examination is necessary in order that he may make a correct declaration.

When samples consist of single articles illustrating goods which are sold in pairs, the interested party must annex to his declaration a statement, in triplicate, specifying the "manufacturing number" of each article and the material of which made, the dimensions, and any other details which serve to distinguish one object from the others of the same general category comprised in the importation.

Parcels of samples must bear, on the outside, in addition to any marks, numbers, and addresses, the word "muestras," or its equivalent in a foreign language.

Customs officers are forbidden to permit importers to alter the condition of objects imported from foreign countries and documented as "samples," either by stamping such objects or perforating them with a view to depriving them of their quality as saleable merchandise. All parcels containing goods not defined as samples in these Regulations, but which, nevertheless, may be sought to be cleared through the Customs as samples, shall render the importer liable to the penalties provided by the Tariff Law.

The complete text of the Regulations may be consulted at the Department of Commercial Intelligence, 73, Basinghall Street, E.C.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED).

Published expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

10. "Adjustable shade for gas and electric light." H. ASHTON. January 2nd.

16. "Electric starters for combustion engines." D. C. S. SANDEMAN. January 2nd.

18. "Electric cables." BRITISH INSULATED & HELSBY CABLES, LTD., AND J. BROTHERTON. January 2nd.

38 "Automatic electric control of petrol-electric, &c., vehicles." V. S. ROBINSON & P. F. SMITH. January 2nd.

41. "Electric ignition for internal-combustion engines." B. T. LANG. January 2nd.

51. "Transmission dynamometer." F. D. EVERETT. January 2nd.

84. "Control of electric motors." J. M. L. SLATER. January 2nd.

90. "Electric lamp or other vacuum tube having a copper leading wire." G. OHTANI, S. YAGO & T. YANAI. January 2nd. (Japan, January 26th, 1916.)

97. "Electric treatment of reaction substances." F. H. A. WIELGOLASKI. January 2nd.

117. "Electrolytic apparatus." I. H. LEVIN. January 3rd. (U.S.A., June 3rd, 1916.)

131. "Electric incandescent arc lamps." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). January 3rd.

139. "Combined starting and lighting dynamos for motors cars, &c." E. C. R. MARKS (Soc. Anon. des Etablissements L. Blériot). January 3rd.

153. "Electro-magnetic switches." ELECTRIC & ORDNANCE ACCESSORIES CO. AND J. ETCHELLS. January 3rd.

155. "Electro-magnetic regulating and switching devices." ELECTRIC AND ORDNANCE ACCESSORIES CO. & J. ETCHELLS. January 3rd.

177. "Ignition systems." W. J. MELLERSH-JACKSON (Philips-Brinton Co.). January 4th.

180. "Magneto-electric machines." G. A. LISTER, M-L MAGNETO & E. A. WATSON. January 4th.

196. "Shock-resisting winding for rotating magnet coils." VULCAN MASCHINENFABRIKS AKT. GES. January 4th. (Austria, May 24th, 1916.)

216. "Locking device for electric lamp globes." W. C. ELLIS (A. Ellis and E. Ambrose). January 4th.

220. "Apparatus for electric welding." T. E. MURRAY & H. R. WOODROW. January 4th. (U.S.A., January 12th, 1916.)

249. "Apparatus for automatically retransmitting through successive lines telegraphic messages received from a distant station." S. E. APPLETON, EASTERN TELEGRAPH CO. & A. FRASER. January 5th.

253, 254, 255. "Process of electric welding." T. E. MURRAY. January 5th. (U.S.A., February 18th, 1916.)

264. "Electric ignition of gas, petrol, &c., internal-combustion engines." W. S. FROST. January 5th.

282. "Alternating-current dynamo-electric machines." LANCASHIRE DYNAMO AND MOTOR CO. & W. STANSFIELD. January 6th.

306. "Electric signalling systems." F. G. BELL, W. C. DAVEY, AND THE STERLING TELEPHONE & ELECTRIC CO. January 6th.

313. "Telephone system." AKTIESELSKABET ELEKTRISK BUREAU. January 6th (Norway, January 15th, 1916.)

314, 315. "Ignition dynamos." C. T. MASON. January 6th. (U.S.A., March 15th, 1915.)

PUBLISHED SPECIFICATIONS.

1915.

13,176. POWER TRANSMISSION SYSTEMS. W. Morrison. September 15th. (September 15th, 1914.)

15,886. APPARATUS FOR CLOSING THE DOORS OF RAILWAY AND LIKE VEHICLES. Knorr-Bremse Akt. Ges. November 10th.

16,113. WATTMETERS AND LIKE INSTRUMENTS FOR THE MEASUREMENT OF ELECTRIC POWER. H. E. Trent. November 15th. (November 11th, 1914.)

17,247. TALKING MACHINES AND DRIVING MECHANISM THEREFOR. British Thomson-Houston Co (General Electric Co., U.S.A.). December 8th.

17,393. LIGHTING ARRANGEMENT FOR OPHTHALMIC AND THERAPEUTIC WORK. W. J. Harvey. December 11th.

17,399. MARINE DEPTH SOUNDING. Sir R. A. S. Paget and Duddell. December 11th.

17,557. APPARATUS FOR COMPILING STATISTICS MECHANICALLY BY THE AID OF PERFORATED BANDS. C. Haggenmiller. December 15th.

17,600. AUTOMATIC WEIGHING APPARATUS, MORE ESPECIALLY FOR LIQUIDS. E. C. R. Marks (Adam). December 16th.

17,662. SIGNALLING LAMP. A. A. Lyon. December 17th.

17,691. ELECTRIC SIGNALLING. International Electric Co., H. E. R. Roose and R. G. le Noir. December 17th. (Addition to 3,520/15.)

17,736. MAGNETIC COMPASSES. Creagh-Osborne, A. J. Hughes and Henry Hughes & Son, Ltd. December 18th.

17,753. CONTROL OF ELECTRICAL MEASURING INSTRUMENTS. M. J. E. Tilney and N. C. F. Jensen. December 20th.

17,895. GYROSCOPICALLY-CONTROLLED TORPEDOES AND LAUNCHING TUBES THEREFOR. Crucible Steel Co. of America. December 22nd. (April 3rd, 1915.)

17,897. AUTOMOBILE TORPEDOES AND LAUNCHING TUBES FOR USE THEREWITH. Crucible Steel Co. of America. December 22nd. (April 3rd, 1915.)

17,923. AUTOMATIC TRAIN-STOPPING DEVICES. A. L. Lyttle & G. I. Costello. December 22nd.

17,954. MEANS FOR CONTROLLING THE SPEED OF A MACHINE. Marconi's Wireless Telegraph Co. & C. S. Franklin. December 23rd.

1916.

The numbers in brackets are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

9. RAILWAY SIGNALLING. H. W. Firth & F. W. Leake. January 3rd, 1916 [102,509.]

385. ELECTRIC INDICATORS. R. E. H. Lovelace and Ediswan & Swan United Electric Light Co. January 8th, 1916. [102,629.]

956. PROCESS FOR OBTAINING SOLID PRODUCTS OF CONDENSATION FROM PHENOLS, FORMALDEHYDE, AND SALTS OF SULPHO-ACIDS. K. Tarassoff & P. Schestakoff. January 20th, 1916. [102,635.]

1,597. RADIO-TELEGRAPHY. J. Bethenod & E. Girardeau. February 2nd, 1915. [100,058.]

1,920. THERMOSTATS. C. E. Hearson. February 9th, 1916. [102,538.]

2,541. ARC LIGHT CARBONS AND METHODS OF MANUFACTURING THE SAME. R. D. Pike. February 21st, 1916. [102,645.]

2,641. PROJECTOR ARC LAMP. J. Brockie and Johnson & Phillips. February 22nd, 1916. [102,647.]

2,697. AUTOMATIC ELECTRIC FOR SIGNALS. W. A. Jeboult & H. S. Stobart. February 23rd, 1916. [102,649.]

3,922. AUTOMATICALLY-OPERATING AND SWITCH FOR MACHINE SWITCHING TELEPHONE SYSTEMS AND THE LIKE. Western Electric Co. & J. G. Hackley. March 16th, 1916. [102,655.]

4,683. QUICK-BREAK ELECTRIC COUPLING MEMBERS. W. T. Henley's Telegraph Works Co. & E. E. Judge. March 30th, 1916. [102,662.]

5,238. TRAIN-STOPPING APPARATUS. A. X. W. Grondin. April 10th, 1916. [102,667.]

5,722. RAILWAY SIGNALLING AND INTERLOCKING APPARATUS. T. E. Haywood, A. G. Kershaw, and Saxby & Farmer. April 19th, 1916. [102,673.]

5,847. ILLUMINATED SIGNS OF THE MONOGRAMMIC TYPE. E. J. Kingsbury. April 20th, 1916. [102,674.]

6,491. TELEPHONE SYSTEMS. E. A. Laidlaw & W. H. Grinsted. May 5th, 1916. [102,680.]

6,619. ELECTRIC LAMP SOCKETS. W. Hunt (Bryant Electric Co., U.S.A.). May 9th, 1916. [102,682.]

8,112. FIRE ALARMS. B. Jones. June 8th, 1916. [102,583.]

10,197. IGNITION APPARATUS FOR STARTING INTERNAL-COMBUSTION ENGINES. Bergsunds Mekaniska Verkstads Aktiebolag & O. J. K. Kahr. July 19th, 1916. [102,698.]

11,740. PREPAYMENT ELECTRICITY METERS. Landis & Gyr. Soc. Anon. September 18th, 1915. [101,535.]

14,416. ELECTRIC CONDENSERS. G. Giles. October 13th, 1915. [101,801.]

14,745. APPARATUS FOR ELECTROCUTING ANIMALS. E. G. Fairholme & A. D. Clarke. October 17th, 1916. [102,704.]

16,563. WIRELESS SIGNALLING SYSTEMS. British Thomson-Houston Co. (General Electric Co., U.S.A.). October 19th, 1915. (Divided application on 14,769/15.) [102,709.]